Popular Science

INVENTIONS
DISCOVERIES
RADIO
AUTOMOBILES
AVIATION
HOME WORKSHOP



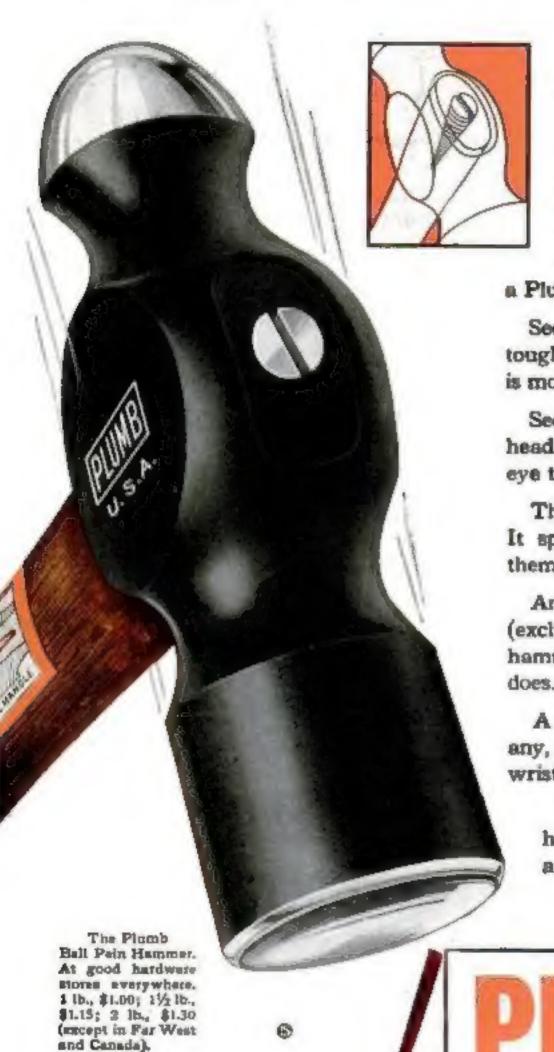
NOVEMBER

Where every day's work is a gamble with death. See page 18

25 CENTS

In this Issue-Houdini's Own Story

This husky hammer makes hard hitting easy



SOLID blows without effort!
When you work on metal
...drive a cold chisel or a
punch...spread a rivet...cut
a gasket... work around the
car...

Do the hard hitting easily with a Plumb ball pein.

See the weight of metal behind that tough face. See how the whole head is mounted off-center to add power.

See the sturdy mounting of the black head on the red handle—the oblong eye takes the handle full-size.

The pein is cone-shaped, not round. It spreads rivets instead of mashing them.

And there is the Take-Up Wedge (exclusive Plumb invention). If ever a hammer needed a tight head, this one does.

A tight head is assured on this, and any, Plumb Tool, with a turn of the wrist on the Take-Up Wedge.

To improve your work, to make hard hitting easy and safe, swing a Plumb Ball Pein Hammer.

> FAYETTE R. PLUMB, Inc. Philadelphia, U. S. A.

PLUMB BOUBLE LIFE
Hammers Hatchets Files Sledges Axes

A Real Long Range Crosley Receiving Set \$9.75

Do not assume from its very interesting price that this very unusual Crosley set is a toy. Its impressive performance alone entitles it to serious consideration.

Heretofore, the \$10 radio was designed only for local reception. Now the Crosley Pup extends the entertainment radius to 1500 miles under ordinary conditions. Place it beside some costly multiple-tube set and operate the dials. Both tune through local stations sharply. Both get the same programs with equal ease and clarity. Both let you tap the infinite enjoyment coming through the air. There is only one difference—the Pup operates with head phones instead of a loud speaker.

The Pup is the newest Crosley set with a price that reflects the volume-production economies of the world's largest builder of radios. It is substantially constructed and permanent in every regard. Its design is an improvement of the famous Crosley one tube set with which Leonard Weeks of Minot, N. D., heard the MacMillan Polar Expedition while the rest of America listened in vain.

Almost overnight the Pup has become the most popular Crosley set ever offered. It is being bought for youngsters whose curious fingers cannot resist the lure of dials and switches; for the cook, the maid, the old folks back home, and for shut-ins. Traveling men are selecting it because of its easy portability, and radio enthusiasts to have an inexpensive check on their large sets. Hear it once—and you will own one too!

In addition to the Pup, there is a Crosley for every price and preference. Operating 1, 2 and 3 tubes, these are encased in handsome Crosley-built cabinets and range in price up to the Super-Trirdyn Special which retails for \$60. Each will deliver the superlative performance that has made the word "Crosley" a hall mark of radio perfection in millions of homes throughout the world.

THE CROSLEY RADIO CORPORATION CINCINNATI, OHIO

Owning and operating WLW, first remote control super-power broadcasting station



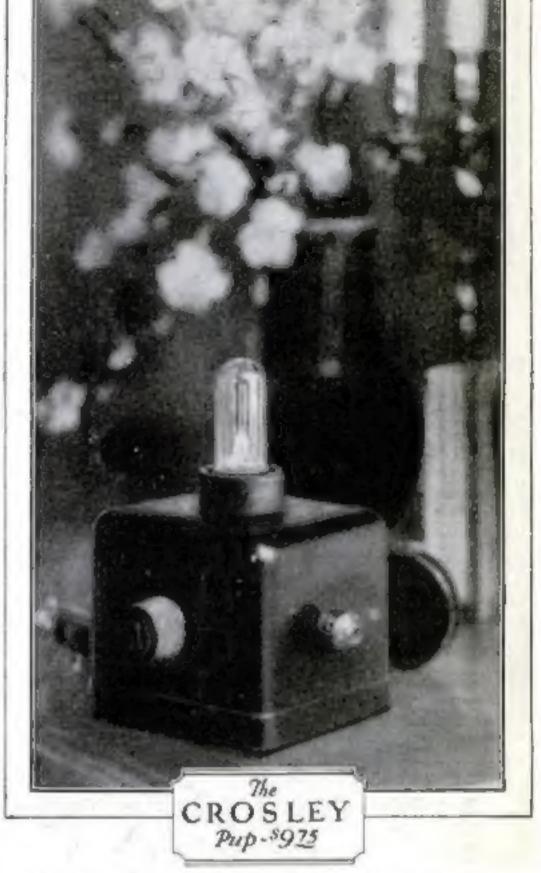
Crosley J Tube 52 S. D. Makogony finished cubinet. slaping pand. Holds all batteries \$32,50



Creetey Super-Tetrityn Regular More compact then the Special Model—but exactly the same superb performance - \$50,00



Crosley Super-Teirdyn Special Matchless performance and exquirite broady combined. Solid makingany cabinet with popular sloping panel - \$60,00



Grosley manufactures receiving sets which are licensed under Armstrong U.S. patent No. 1,113,149 and priced from \$9.75 to \$60.00 without accessories. None of the prices quoted include batteries, tubes, headphones, etc. Add 10% to all prices west of the Rocky Mountains.

Crosley De Luze Combination

Musicane De Luce 127.50
Super-Triedyn Special 60.00
Console Tubia 25.00
Complete 112.50



Crasley 2 Tube 51 S. D.

A true long range sel, easy to tune and handsome in appearance \$23,50

CROSLEY RADIO

BETTER · COSTS LESS

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Popular Science Monthly

The Magazine of Invention and Discovery

NOVEMBER, 1925; Vol. 107, No. 5 25 cents a Copy; \$2.50 a Year



Published in New York City at 250 Fourth Avenue

Coming Next Month

Pictures from the Clouds—The story of a marvelous school where Uncle Sam trains young photographers in the new science of aerial photography.

How to Get Ready for Christmas—Novel and entertaining ways to make holiday decorations will be described and illustrated in the Home Workshop. Also, toys and games you can make for the boys and girls.

Your Winter Driving Troubles—Simple precautions you can take to save yourself the difficulties encountered in cold weather—useful facts that every motorist wants to know.

More than 200 other fascinating articles and pictures, giving you all the news of radio engineering, science and invention, strange and unusual things people are doing, together with practical ideas for the automobile, the home, the home workshop, and the use of tools and machinery.



AMATEUR radio builders are performing wonders these days. Through the aid of expilcit constructional articles such as appear every month in POPULAR SCIENCE MONTHLY they are learning how to build receivers of remarkable efficiency. Here, for example, is a young man of New Rochelle, N. Y., with a tremendously powerful eighttube neutrodyne set he has just completed. What kind of a set can you build? Turn to page 59 of this issue for the announcement of a forthcoming cash prize contest for home radio builders. Details of this contest will be announced next month,

POPULAR SCIENCE MONTHLY

Instead monthly. Single copy. If centr. Yearly subscription to United State, its presented, and Counter for the foreign countries. IJ. Interval as second-class matter Dec. 28, 1916, as the Post Office at New York under the act of March J. 1879; additional entry as second-class matter at Duneffee. N. J. Enterval as second-class matter at the Post Office Department. Canada. Printed in U.S.A. Cappright, 1975 by the Popular Science Publishing Co., Ipr. The contents of this magnitude must not be reprinted without perceivant. In presenting in its editorial columns mannerous mortes of new products of applied science. Purellan Science Mostrait of new and anderwate the business methods of the individuals or concerns producing them. The one of Popular Science Mostrait articles, or quotestions from them for stock-reling schemes in never anthogonal.

O. B. Capen, President and Trensurer; R. C. When, Vice-President; A. L. Cole. Scientary.

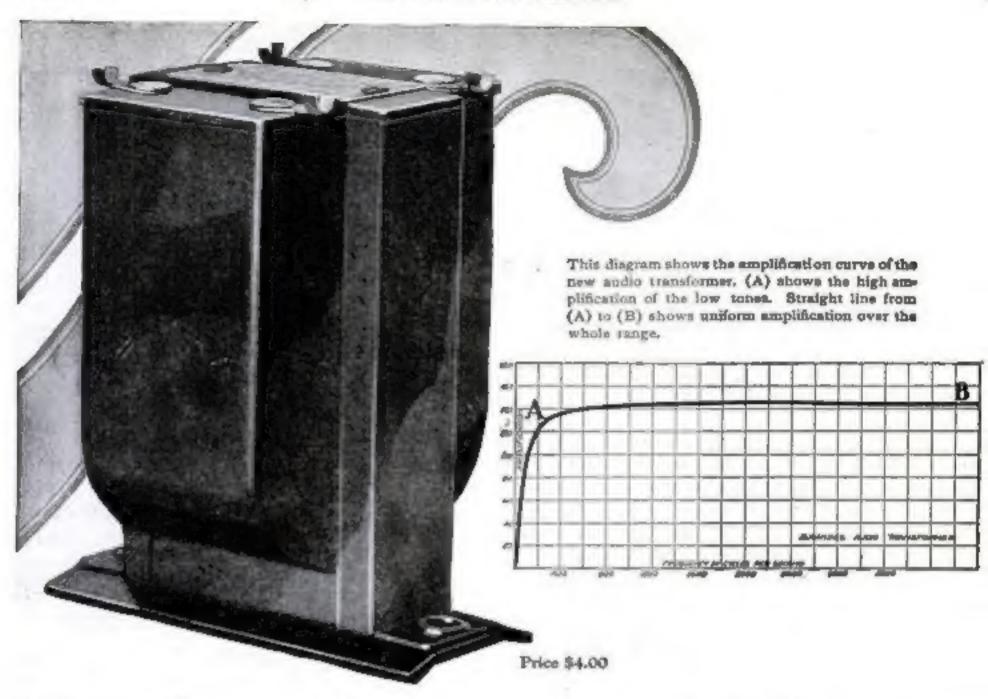
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And Other Timely Articles and Pictures

Better Shop Methods. 22.

Edgy Personal Jestine Vol.



New low tones—new high tones with a Brandes Transformer

HERE'S a new audio transformer that "lets through" the deep and the high tones—that gives an even amplification over the whole range.

It amplifies at a high ratio of 1 to 5 without any transformer distortion. And its perfect amplification of the overtones gives mellowness and reality.

Send for an interesting booklet describing Acoustics by Brandea.

Prices slightly more west of the Rothics and in Canada.





The Brandes Cablest Speaker of mahogany, finished in walkist brown. The same unit, quality of tone and even greater volume than the Type-H. \$30

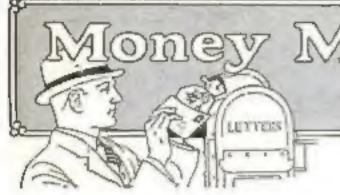


The Brandes Cone—a truly decorative bit of farniture that conceals a remarkable speaker \$38

Brandes

EXPERTS IN RADIO ACOUSTICS SINCE 1908

C 1905 Copyrighted by Brandes Products Corporation



Making Opportunities for Popular Science Readers

The Direct Road to Success

The Money-Making Opportunities Section of POPULAR SCIENCE MONTHLY has been established as a service to readers of this magazine

Among the announcements of correspondence schools, resident schools, publishers, people wanting agents and the innumerable other advertisements on pages 144 to 174, you may find the very opportunity you have been looking for.

Today the direct road to success is knowledge -not general knowledge, but specialized know-

ledge. To know more about your job than the other man is the first step toward success. The men who succeed have specialized—they have studied, they have learned more about the work they are doing than their fellow workers.

Does your present job hold your interest, or have you always longed to do something different? You can get ahead much faster in a job that you are interested in intensely.

Here is your opportunity to get into the work you have always wanted to do.

Whether your ambition is to be a lawyer or a master carpenter, a salesman or the owner of a garage, an artist or an electrical expert, a public speaker or a pharmacist, there are schools and books advertised in the Money-Making Opportunities Section of Popular Science Monthly ready to help you secure the specialized training you need to get ahead.

If you would like to have your own car, your own home, have money in the bank, give your

family the best things in life, determine now to be the boss intead of a wage-earner.

Correspondence schools and similar opportunities for specialized study is the way out for the man handicapped by lack of education. And this specialized education can be secured without its interfering with your present employment—and

at a cost you can afford.

POPULAR SCIENCE MONTHLY is the great meeting place for men who want to succeed and the schools and publishers that can help these men achieve their ambitions.

Start on page 144 and study every advertisement in the Money-Making Opportunities Section. Decide what most you would like to do and then fill in the coupons or write to the advertisers who are ready to help you reach the top of the profession or trade you have chosen.

\$100 in Cash Prizes

For the best letters in answer to the questions:

What advertisement in the MONEY-MAKING OPPORTUNITIES SECTION interests you most—and why?

we will pay \$100 in cash prizes. For full details—

See page 144

With specialized training in the field you have selected, and determination to get ahead, you can be a leader instead of a follower. Only through education, plus determination, can you succeed in life.

As a further incentive to start on the road to success, we are offering \$100 in Cash Prizes for the best letters telling us the advertisements our readers like best—and why. See the details of this prize offer on page 144.

You will find Scores of Opportunities for Making More Money in the "Money-Making Opportunities" Department, starting on page 144 of this issue.

SLAVE TO YOUR DESIRES

FROM the mellow depth to the highest pitch of harmony - the improved APEX Receiving Sets bring in, with startling clarity and naturalness, all of the delicate gradations of the entire range of sound-whether the highest soprano or the deepest of bassos profundo.

The charm of naturalness, combined with greater distance getting ability, positive selectivity and full volume, plus the enchanting elegance of design and finish, present radio receiving sets that are most satisfactory in every element of operation and a real delight to all whose choice of home furnishings is guided by true appreciation of artistic and refined beauty.

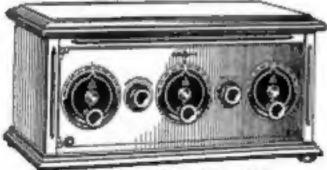
Only a dependable merchant is given the APEX dealer franchise. Your APEX dealer will gladly make personal demonstration of APEX Quality Radio Apparatus.

APEX ELECTRIC MFG. CO. 1410 W. S9th Street Dept. 1103

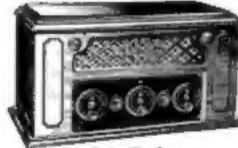
Also makers of the famous APEX Versior Dials and APEX Rhecotate, which are sold by every good dealer in Radio.

Chicago





Apez Super Five, Price \$95 without accessories



Apex De Luxe Price \$135



Apex Coasole Entertainer, Price \$27.50



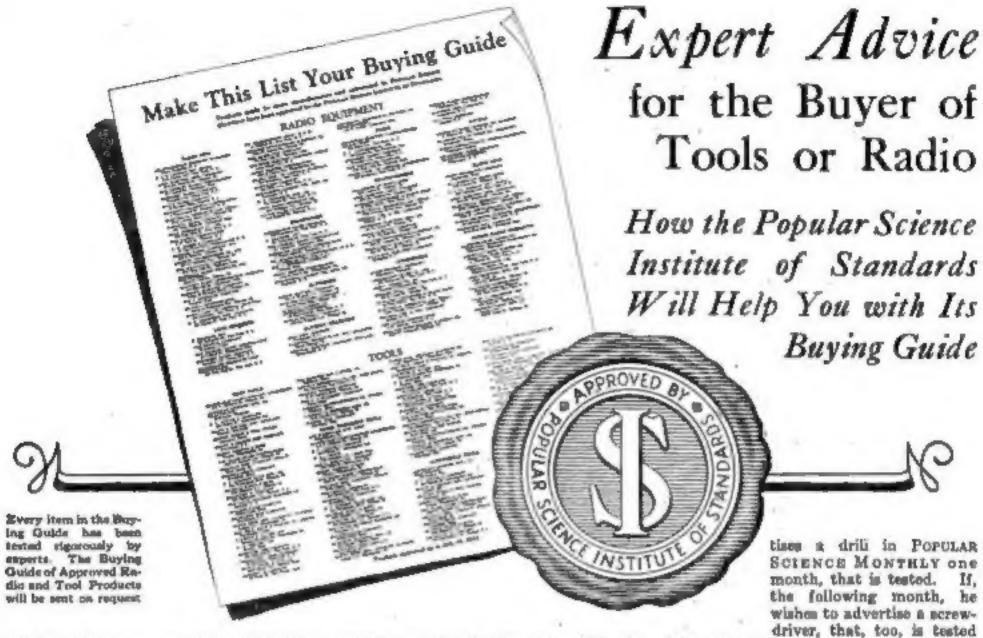
Price \$225





Copyrighted makerial

Prices West of Rockies slightly higher. Canadian prices approximately 40% higher.



HERE is one essential article that always is taken on buying expeditions. That is money. But an increasingly large number of the readers of POPULAR SCHENCE MONTRLY. and their friends, are taking a second companion when buying radio and tool equipment. That is the List of Approved Products of the Popular Science Institute of Standards.

Not having an engineer at their side to advice them in purchasing, they find this list of products that have passed the rigid tests of a staff of expert engineers an able substitute. For, in selecting a product that has been approved by the Popular Science Institute, they know they will get an article of sound quality, efficient construction, and one capable of standing up under usage.

All this has been proved in the Institute laboratories at New York University. There, under the supervision of Prof. Collins P. Bliss, Head of the Department of Mechanical Engineering, Director of Testing Laboratories of that university, and Director of the Popular Science Institute, the tests are conducted. This fact alone insures the thoroughness and impartiality of the Institute's tests.

THE extensive nature of these tests is not always appreciated. Some manufacturers, as well as readers of the magazine, assume that they are made more or less on the "try-out" principle. Only recently, when a certain radio manufacturer was requested to loan a sample loudspeaker for test, he suggested that an engineer from the Institute be ment down to his place to 'look it over and try it out," adding that he guessed that was "all that was necessary." Far from it! Actual laboratory tests cover an

extended period of time and require the use of complicated testing equipment. In fact, the manufacturer who is anxiously waiting the Popular Science Institute of Standard's certificate of approval often becomes impatient at the delay-from two weeks to three months, according to the nature of the product-required to complete the tests. Should the results of the test be unsatisfactory, the product is disapproved and cannot be advertised in POPULAR SCIENCE MONTHLY.

ANOTHER impression that some people entertain is the belief that the Popular Science Institute tests one product of a manufacturer and passes his whole line on the basis of that test. This is not the case. If a manufacturer adver-

POPULAR SCIENCE Monthly Guarantee

The above test on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guaranteen every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly. THE PUBLISHERS. tises a drill in POPULAR SCIENCE MONTHLY one month, that is tested. the following month, he wishes to advertise a screw-

before the insertion of the advertisement is allowed. And it is surprising to note the difference in various products made by the same manufacturer. This is especially true in the case of radio apparatus, for continual experimenting is going on, and some equipment is put on the market by reputable manufacturers that requires considerable more experimenting.

LETTERS received by the Institute POPULAR SCIENCE MONTHLY are taking full advantage of the service offered them and are being guided by the results of the tests made by its engineers. In the morning's mail the other day, the following note was received which is just an illustration of how thousands are depending on the Institute's List of Approved Products:

GENTLEMEN:

Please send me your list of approved products-both tool and radio. I received your list when the Institute was first started and profited much by using it.

This list has since been misplaced and, as I am in the market again, would appreciate your sending your latest list.-W. E. S.,

New York, N. Y.

- Crynthia make

The service of the Popular Science Institute of Standards is entirely free to both readers of POPULAR SCIENCE MONTHLY and wholesalers and retailers of Radio and Tool Equipment. Address inquiries, or requests for the List of Approved Products, to the Popular Science Institute of Standards, 250 Fourth Avenue, New York, N. Y.



When Science Is Used in Making Doughnuts;

►HE hit-or-miss method of doughnut making, where the old-fasho ioned baker dipped his dough in an iron pot of bubbling, boiling fat, has been superceded.

Today, doughnuts are made in quantity under scientific conditions. The all important matter of the temperature is gauged accurately by Secon Thermometers. Guess work is eliminated.

The housewife who makes her own doughnuts can obtain the same uniform results that wholesale bakers get by using the Taylor Deep Fat Frying Thermometer.

The same scientific accuracy that has been introduced in the old-fashioned art of doughnut making is available to all manufacturers who use heat treating processes.

Whether you make doughnuts by the thousands, pack boat loads of salmon at a time, can acres of vegetables a day, or bake bread by the mile, there are Freet Instruments that will insure your getting the absolute uniformity of product that is the backbone of doing business on a volume basis.

Taylor Instruments for Indicating, Recording and Controlling heat—the "Sixth Sense of Industry"—has made possible this mechanical age,

To Manufacturers

In the New line of 8000 different kinds of Heat Indicating, Recording and Controlling Instruments, there are instruments that will help you get absolute uniformity in your production. It will pay you to learn how other manufacturers are using the Sixth Sense of Industry to get uniform results. Informative literature on any type of instrument will be sent you on request. Or our engineer will consult with you on the application of New to your particular manufacturing problem.

laylor Instrument Companies

Mala Office and Factory ROCHESTER, N. Y. U. S. A. Cumdian Plant: New BUILDING, TORONYO

Suce Office Thermometers An aid in promoting human efficiency.

Swag Bath Thermometers To enable you to get the most good from your bath.

Miller Home Set Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of nocurate resulm in cooking.

Fort Wall Thermometers To help you maintain a temperature in your house conducive to good health.

Moder Quality Company To show you the right way in unfamiliar country.

Fone Fever Thermometer) A necessity in every

From Storrungwide Forecasts the weather twenty-four hours ahead with depend able accuracy.

Tyoos Hygrometer To enable you to keep the bumidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a pastal, for booklets on any of the above.



Sphygmomanometer, Pocket and Office

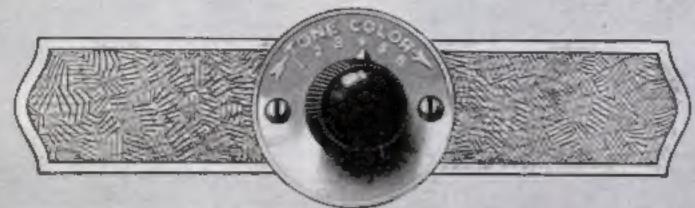
Som Urinalysis Glassware.

New Fever Thermometers. Bulletins on request.

THE SIXTH SENSE OF INDUSTRY



ONE OF THE GREATEST OF RADIO DEVELOPMENTS



Grebe "Colortone"

THIS tone control is, perhaps, the greatest of recent Grebe inventions.

Grebe "Colortone" enables you to alter to your taste, the quality of speech or music from high, thin pitch to deep, round tones with all the variations between. The Synchrophase is independent of the loud speaker's influence.

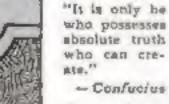
With the "Colortone" a complete range of tone characteristics is thus available and the best qualities of any loud speaker are brought out.

The "Colortone" makes it possible to suppress considerably the high pitch frequencies caused by heterodyne interference of one station with another and also to reduce, to a great degree, disturbances due to static.

Ask your dealer to demonstrate this as well as the many other exclusive Grobe features; then compare

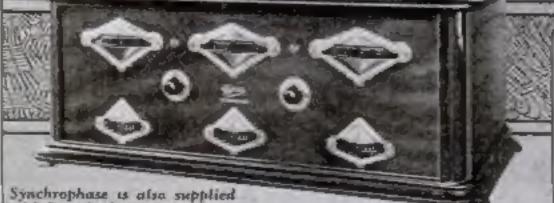
A. H. Grebe & Co., Inc., Steinway Hall, 109 West 57th St., N. Y.
Factory: Van Wyck Boulevard, Richmond Hill, N. Y.
Western Brunch: 44) So. San Pedro Street, Los Angeles, Cal.

This company assess of the property of the property of the part of



The constant seeking for truth has created the "Colortone" and other Grebe advances in radio reception.

1 Deter 149



Synchrophase is also supplied with base for batteries and in a de luxe Console model.

All Grebe apparatus is covered by patents granted and pending.

Congressed industrial



POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor

November, 1925



The First 68 Prize-Winners

John and Mary Newlywed Announce
Results of the June Competition
in Our Great

\$10,000 Contest

HE bome-making troubles of John and Mary Newlywed are over. And it is only fair that we now should let this enthusiastic young couple announce the 68 prine-winners in the first of the four Monthly Contests that made up Populan Science Monthly's \$10,000 "What a Wrong" Contest.

First of all, John and Mary will introduce you to E. B. Benson, of Rock Island, Ill., winner of the first prize of \$500 in the June "What's Wrong" Contest. With his little daughter, he greets you with a smile in the photograph at the foot of this page.

Next, meet Louise Gardiner Walshe, winner of the second prise of \$100, and Edwin T. Brown, winner of the third prise of \$60. When you turn

this page, you will look into their faces. Finally, in the list at the top of the next page, you will meet the winners of the five prises of \$10 each and the 60



THE first three prizes in the June "What's Wrong" Contest have been awarded as follows:

FIRST PRIZE, \$500 E. Bernhard Benson, Rock Island, Ill.

SECOND PRIZE, \$100 Louise G. Walshe, Jersey City, N. J.

THIRD PRIZE, \$50

Edwin T. Brown, Pittsburgh, Pa. Names of winners of the other 65 prizes will be found on the next page.

prizes of \$5 each. Of course, we'd like to have you see their faces, too, but space does not permit.

All those awards were made by the three

official judges after careful consideration of thousands of entries. The surprising thing about the June contest was the targe number of readers who sent in correct anwers to all of the eight "What's Wrong" pictures, showing John and Mary doing odd jobs about their new home. Contestants were saked to find out from each pleture what John or Mary (or both) were doing wrong, and to tell why it was wrong; also what desiberate mistake the artist made in drawing each picture.

The general excellence of the contributions and the fact that so many



John and Mary

You can see how glad they are to find out about the mietakes they made in doing odd jobs about their new home

contestants told exactly what was wrong in each case made the task of choosing the 68 prize-winners a difficult one. In reaching their final decisions, in accordance with the rules of the contest, the judges based their selection of winners on three points—accuracy, clearness, and skill of presentation. A number of those who submitted correct answers failed to win one of the prizes simply because they failed to state their answers clearly and concisely

Many other entries that showed painstaking and enthusiastic effort, had to be thrown out because one or more of the

answers were inaccurate.

Interest in this remarkable contest has been world-wide, as evidenced by the fact that hundreds of entries arrived from dutant countries, including Russia, India, Australia, South America, England, Ireland, and France. Many of the entries showed remarkable ingentity. A number of contestants, for example, submitted their answers in the form of bound volumes with handsomely designed covers, the contents arranged with pictures of John and Mary carefully pasted on the pages and the answers neatly handprinted beneath the pictures. Several people redrew all eight pictures of John and Mary to show them in each case doing the Job right, and in each correcting our artist's deliberate error A woman painted her own portrait on the cover of her bound entry. Several contestants inclosed their entries behind glass in large frames of their own workman-

The awards of all cash prizes were made



Wins the First Prize of \$500

E. Bernhard Henson, of Mock Island III., whener of the first prize of \$500 in the June Contest, with his little daughter June

Additional Prize-Winners in the June Contest

FIVE PRIZES-\$10 EACH

H. N. Aldrich, Rosalte, Neb. Lemis J. Day, Floral Park, N. Y. Edward J. Frank, Schenertady, N. Y. Harold W. Readen, Monitor, Oreg. Edwin C. Warren, Washington, D. C.

SIXTY PRIZES-\$5 EACH

Herry C. Branch, Cleveland, Ohio. Charles Bunting, Senta Crus Calif. Harry C. Burnham, Cremston R 1 Jacob H. Cermichael, Cierro, III. Mrs. W J. Chievitz Cleveland, Ob a Harry B. Cook. Delta, Colo. Mrs. Maresa M. Cope. Richmond. Va. Mrs. John F Contello, Northport Wesh. Samuel Lee Craig, Principio Furnece Md. Ernest H. Dale, Philadesphie Pa. Harold F Dawes Petersburg, Assalts Mm. Alma R. Swing, Capitan, N. M. Dwight V Fisher Vincland N J. Capt. Wm. Alliana Fuller Cocos Fla. Joseph C. Gilbert, Providence R L. George H. Groth. Chicago. Ohio Roger Heckney Birmingham Ala. Carl M Hartman, Toledo, Omo C. M. Hand, Beartie Wash. B. H. Hodges, Bluefield W Va.

W & Hudgins Hampion Va. Walter J. Levin, Jr. Resdiville, N. C. Rinel Jacobs, Winnipeg Can. H J. Johnson, Durath Minn. D R. Kanporta, Chrystone Wyo. Reuben Kock, Dayton, Ohio Ruph J Leonard, St Louis, Ma. D W Lavingston, Milwaukee Wis. George Wm. H. Long, Indianapolis Ind. Nuna Ervine McLelland Houston, Tex-Matt H. Miller Edmonton, Area. Cus., Malrolm & Moren, Rolling Boy Wesh, W Nelson Meepler Ellicott City Md. W. C. Nicol, Pittsburgh, Pa. W and R. Nottingham Utica, N. Y. C. E. Praraon, Cleveland. Obio-John LeRoy Prochks Cleveland, Ohio L H Poston Arthus Mins Royden & Reed Manchester W H. R Richard Jersey City N J

H M Rose, Huntington, Pa. Forrest M. Rous Providence, R. 1. Herman J Rowe. Pocomoke City Md. Muuro G Seens Mexico City Mex. A Don Seaman, Muskegon, Mich. Thomas S Short Amegamett N Y Raymond Shotwell So Tacome. Week. Hyron W Biog Tucson, Arts. H T Shrum Oshkosh Wis. A Wilbert South, Los Angeles, Calif. Albert L. Saedaker Mt. Ephraim, N. J. Arthur Start, Frendale, Mich. Mery A Strickland, Brooklyn, N Y Paul Sutherland Inspiration, Aria. H. M. Turner New Haven Conn. Mrs. H. B. Walker New Orleans La. Lynn C Watson, Burmingham Ala. Max M. Weber Sharon, Pa. F Warren Wells Jr Westfield Mass. Harry Williamson, Whiteville, Tenn.



Second-Prize Winner
Leute Cardiner Walshe, of Jersey City.
N J., winner of the second price of \$100.

by three men of wide experience and high standing in the field of mechanics—Prof Collins P. Blim, Director of the Popular Science Institute of Standards and head of the Department of Mechanical Engineering at New York University; Dr. Hazen G. Tyler, Amociate Director of the Popular Science Institute of Standards and Associate Professor in charge of Experimental Engineering, New York University; Alexander Senauke, M. E.

E.E., Radio Engineer of the Popular Science Institute of Standards.

Their selections of the prize-winners in the second of the Monthly Contests, which appeared in the July issue, will be announced in the December issue of Popular Science Monthly; winners in the August contest will be announced in the January issue, and the September contest winners in the Pebruary issue. Names of winners of the Grand Prizes, totaling \$6000, to be awarded for the best solutions to all the 32 pictures appearing in the four Monthly Contests, will be announced by the judges as soon as possible thereafter

From start to finish, our great \$10,000 Contest has met with enthusiastic response. Judging from the thousands of letters we have received, we are quite sure that every reader who has followed John and Mary through their vigorous, though sometimes painful, efforts in home-making, has found it profitable and entertaining. We are sure, too, that every reader will join with us, and with John and Mary, in congratulating the 68 winners of cash prizes whose names are announced here.

And, remember, even if you have failed to win one of the prizes in the June contest, don't be discouraged, if you submitted answers also in the July, August, and September Contests, as most of the contestants have, your chance of winning one of the prizes in these contests is just as

good as anybody's. In fact, the judges who now are working on the July Contest inform us that a large number of persons who made trustakes in the June Contest have submitted correct answers to all eight pictures in their second attempt. That means, too, that even though you may have had a bad start, you have not lost your chance of winning one of the big Grand Prizes to be awarded for the best answers to all the pictures in all four Monthly Contests.

There still remains \$9000 to be awarded—\$1000 for winners of the July Contest, \$1000 for the August Contest, \$1000 for the September Contest, winding up with the \$6000 for the Grand Price Contest.



Third-Prime Winner

Edwin 7 Snown of Pittsburgh Pa. winner
of the third prime of \$50 to the June Contest

WATCH for the names of prize-winners in the July "What's Wrong" Contest. They will be published in next month's issue. Names of the August Contest winners will appear in the January issue, and the September Contest winners will be printed in the February issue.

70) hy a Thunderstorm Can Break an Airship

As a thunderstorm gathers, swift rising corrects of warm oir product a "bumpy" path through the clouds for an eirsbig-



Now a thundersland is foreged by the energies of small ententus clouds pushed together by swiltly rising warm corrects.

Y THE remarkable drawings above, our artist presents a graphic explanation of the effects upon an airship of a severe thunderstorm such as that responsible for the recent wreck of the Shenandouh

In the largest picture is shown how a "line squall" in formed by the meeting of uprushing warm air and descending currents that have been cooled by contact with raindrops and ice crystals of the upper atmosphere. Setted by these conflicting currents, a mighty alreship is ripped asunder.

The two drawings at the left show how a typical thundercloud is formed by the merging of small cumulant clouds pushed together by swiftly rising currents of warm air. The upper drawing shows as well how the irregular motion of the rising currents makes a "bumpy" path.

The picture in the upper right-hand corner demonstrates why lightning is of little danger to dirigibles. The discharge is carried along the metal framework and passes harmlessly to the ground

How I Unmask the Spirit Fakers

By Houdini



Houdint in Disgulse

Bo well known is Moudint that he must nesume various odd diagunes when rapoung the trickery of false spiritualistic med ums. Here he is in the gains of a deaf old man. In this rite he was permitted by a New York medium to talk with the "spirit" of a sou be never had

HILE I was playing an engagement in a mid-western city late last spring, a newspaper reporter called on me at the theater

"Houdanl," he said, "there's a spiritualintic medium who has been in town for more than 25 years. Would you care to come round with me and, look him over?"

Now, telling me that a supposedly genuine medium is in the same town with me is like informing an enthusastic fisherman that he's near a trout stream. For 85 years—during my whole career as a professional magician—I have been studying and investigating so-called paychic phenomena—spiritualism, occultism, clairvoyance, mysticism, telepathy, and similar manufestations of

apparently supernatural origin. My investigation has been literally continuous. I never have dropped it for so long as a day. The practice of my profession has taken me to virtually every country on earth, and my travels have enabled me to observe and study the psychics of many lands. And my interest in the subject is more been, if anything, today than it was when it first engaged my attention

This probably is because my interest in psychic phenomena is personal rather than professional. I have pursued my investigations because I have found them a fuscinating kind of scientific research, not merely because seeking to explain the mysteries produced by others may seem to bear some relation to the work of one who is himself a professional mystifier.

ALSO, the really tremendous popular interest in occult phenomena that has spring up in recent years has stimulated me in pursuing my investigations. Every day that I appear on the stage, hundreds of people in the audience sak me questions regarding spiritualism, telepathy, and kindred subjects. Every day my mail contains hundreds of questions of the

The public wants to know whether there are such things as "spurits," whether it is possible for one man by mere exercise of his will to transfer his thoughts intelligibly to the brain of another man, and so on and so on

And as a servent of the public, which every public performer undoubtedly is, I consider it my duty never to let a chance slip of obtaining authentic data on the subjects regarding which the public is looking constantly to me for information.

So it was with engerness that I accepted the reporter's suggestion that I accompany him and another man, who proved to be the county prosecutor, out to the medium's home.

Now, despite any impression that may have been created by my activity in exposing fraudulent mediums, in regard to appritualism I am not a skeptic. Although I have found no genuine physical phenomena medium, by which I mean one who does not produce his effects

by purely natural means that any trained magician can duplicate. I have still an open mind. I am willing to be convinced-even to believe, if a medium can demonstrate to me that he actually possesses true psychic power. And when I went to the home of that veteran medium it was with every hope that he actually might prove capable of establishing communication with the spirits of the dead. One who had sustained his reputetion for more than a quarter of a century in the same city, I reasoned, well might be assumed to be gapuine. Besides, I am far too busy to waste my time "investigating" self styled mediums, who generally are believed to be frauda.

ONCE again, though, I was disappointed. This medium was just another trickster. His "psychic power" was due to his ability as a conjurer. His methods, in short, were marely a crude adaptation of those by which professional magicians mystify audiences from the stage. He was exceedingly clever, but I had unmasked him before his scance was completed, and as a result he was arrested as a fraud

Moreover, after my exposure of this man, the police of the city began a drive against fake epiritualists, which resulted a few weeks later in rounding up 20 of these





Simple but Mystifying

Houdini (at right) demonstrates a simple trick by which the fake medican under cover of Jackness, freet are hand to make the laparita perform. After stroking he subject a arms and hands a few times with his linger-tips above), he defly removes one hand, placing the other on the backs of the subject's hands in such a way that the change is not touced. At the left Houdini is seen writing on a slote with his free hand and ringing a small bell that he has placed in his prouth

THE Mystifying Trickeries of Fraudulent Mediums Laid Bare by the King of Magicians in the First of a Great Series of Articles

swindlers who prey upon the credulous, the grief-stricken, and the troubled.

This man was what is called a "trumpet medium." The term probably requires an explanation. A trumpet medium is one who evokes the "spirits" with the aid of trumpets—cones of metal or other material that resemble the fog borns carried by the old-time sailing vessels. The trumpets ordinarily are placed on a table around which the medium and those attending the scance sit in a "circle," each person clasping hands with those on his right and left.

NOW, the medium, being part of the circle, apparently cannot move without those who are holding his bands being aware of it. Yet, as soon as the light in the room is extinguished, queer things begin to happen. You hear "apirit voices," you feel the tapping of "spirit hands" on your head and body; odd, tapping gounds, which you are informed are the sound of "spirit feet," are heard seemingly in the sir, or on the walls and cellings. You hear sweeping sounds, too, which you are told are made by "spirit garments." Sometimes the trumpets, which are distinguishable in the darkness because of luminous rings that are placed upon them, are seen to rise from the table and apparently float about the room

To one who visits a seance for the first time, these effects are most uncanny. You are quite ready to beseve that they actually are enused by "spirits." Certainly, you tell yourself, the medium, with both hands securely held, is unable to get free to talk through the trumpets, raise them in the air, or tap them on the ceiling.

Well, as one who for 36 years has been freeing himself from every sort of bond, encumbrance, and restraint that human ingenuity can devise—bandcuffs, ropes, chains, straitjackets, locks, bolts, prison cells, trunks, safes, and packingcases among them please permit me to testify that for a medium to free himself from a spiritualistic circle and so get hold of the trumpet is child's play!

And that's exactly how the wonders of the trumpet medium are performed. The medium gets free of the circle—or releases one hand or

foot at least-and proceeds to manipulate the trumpets. Bometimes it is a confederate who permits him to escape. Sometimes, as I shall show presently, he does it through his own cleverness. The "spirit voices" that you hear are the medium's voice, disguised, issuing from a trumpet In the darkness it is virtually impossible to trace to their source the sounds of a faint voice distorted by the megaphonic effect of a trumpet. Try the experiment yourself, and see. The "spirit rappings" and sounds of "spirit wings" are made by the medium's fingers against the side of a trumpet. The tape which the sitters feel are delivered by the medium with a trumpet. To touch the ceining with a trumpet or to reach a mitter at the far end of the table, the medium lengthens a trumpet by attaching it to another trumpet by means of the mouthpieces, which are made to fit one inside the other



Where Footwork Summons the "Spirits"

With both hands held securely by his neighbors in the afance "circle." how can a medium get hold of a transpet and produce mysterious "apirit veloce"? One way to do it is by a little clover footwork, says Houdist

Some trumpet mediums also produce "apirit voices" in the daylight. The medium holds the large end of the trumpet near his mouth, and whispers into the instrument without moving his facial muscles, while at the same time carrying on a casual conversation with the sitter. You've seen ventriloquists on the stage disguise the fact that they are speaking by much the same method.

THE particular medium of whom I write performed most of the usual tricks with the trumpets. He also caused a guitar, placed on the table before him along with the trumpets, to be played while he sat with his hands apparently covering those of the persons who sat at his right and his left. He established communication with the "spirit" of the son of one of the sitters, the "spirit" of an Indian chief, who upoke pldgin English in a deep hase voice, and the "spirit"



Amazing Wonders of the Dark Revealed as Simple Child's Play

"For a medium to free binnelf from a spiritualistic 'ejecle' and so get hold of the trumpet is child a play " In the circle his right wrist is held by " be man at his right, while he grips the wrist of the man at his left. By

twitching jurky movements, as if in the throns of sublime ecutary he manages in the dark to transfer his grip from left hand to right freeing his left hand, with which he picks up the transpet. The "circle" remains unbroken

of a French opera singer, who led us in singing "Nearer, My God, to Thee."

As I said before, I attended this seance in the hope that the medium might produce something in the way of a genuine spirit manifestation. His methods, though, were so like those of fraud mediums whom I had seen and exposed that I was surprised at having thought him genuine in the beginning, and feared he would turn out to be a trickster. And so, when the opportunity presented itself,

I alipped out of the circle in which I sat and smeared lampblack on the trumpets. I waited until the medium had completed his trumpet work, then I rose, drew an electric fischlamp from my pocket, and directed its rays across the table.

FT WAS a startling, though somewhat

comical picture that the sudden light disclosed. For there in the circle sat the medium holding the guitar above his head, and his hand and face were as black as a coal heaver's from the lampblack I had used!

By an ingenious trick he had freed his hand to manipulate the trumpels

and the guitur.

"You could feel it if I raised my hand, couldn't you?" he had asked one of the mitters beside him, and, so he spoke, he actually raised his hand and did not put it back, but substituted an Indian rest. -a stone of about the size and weight of his hand, covered by a handkerchief as had been his hand. The sitter, feeling the weight of the stone upon his hand, supposed, naturally enough, that the medium's hand had been replaced after its withdrawal. On this trick rested almost entirely that medium's claim to the possession of psychic powers.

Thirty-five years among these vultures has convinced me that they are the most contemptible and the meanest criminals that walk the curth. The confidence man, the burgier, the prespeciest, the highwayman, and others who live by robbing their fellows, must take chances. They meet their victims on even ground and triumph through their wita, their

strength, or their courage.

"HE fake medium, though, works with everything in his favor. His victims will believe in him. They are griefstricken by the loss of a loved one, unnerved and troubled by financial reverses, distracted by the diagrace brought upon thera by their wayward children. In their search for consolation, in their troubles, for guldance in their difficulties, they grasp at straws. And the medium adroitly worms their secrets out of them, plays upon their fears or their grief, impresses them by elaborate hocus-porustrumpet work, slate writing, spirit rapping, table-lifting, spirit photographs and the like—quickly has them in his toils and strips them have of everything they own.

In the sheltering darkness, which makes it impossible for the sitters to observe anything he does, it is not necessary for the medium to be even a clever conjurer. Tricks that in the light would bring him nothing but a laugh of derision, in the darkness are startling and inexplicable.

I have caught a medium lifting a table —he claimed, of course, that the aptrita did it-by equipming upward in his chair until the edge of the table was caught by a hook attached to his belt, while a confederate raised it a corresponding distance on the other side. Can you imagine a stage magician getting away with anything like that? Or can you imagine

the despite the first the

"Spirit Facus" of Paint

with the beginning of the purchase it from room suddenly shine "faces from the sperit world"—a mystifying wonder But wooder is performed, Houdied explains. samply by means of face master couted with hundrous point and attached to lary tenge manipulated by a confederate concented beland a screen. The lower picture shows Moustini executaing one of these masks

a stage magician impressing an audience by having his amistant tap certain persons on the shoulders and run his fingers through their hair! Under cover of darkness, though, and masked by the cloak of religion, such ridiculous trumpery

becomes most impressive.

I remember in Chicago, quite a few years ago, a medium who had gained a blg reputation by doing nothing more remarkable than the last thing I mentioned. This medium was a woman. She insisted upon being firmly held during her séances. Yet as soon as the room was made dark, the sitters felt taps on their shoulders and other parts of their bodies. Fingers were run through their hair. Their watches were matched from

their pockets and thrown to the floor. I attended one of this woman's seances and I was completely mystified. She seemed to have no accomplices. I know she had not left her seat during her manufestations, for I myself was holding her. However, my experience and my common sense both told me that her work must be accomplished by some natural means, so the second time I visited her spiritualistic chambers I went prepared.

As soon as the light was extinguished I

poured a bottle of indelible ink over my hair. In a few moments, as I expected, there came a light touch on my head. I moved my head so as to encourage the

> саленнов, and the "apurit" apent quite a little time in pulling my bair and dusarranging it.

> AND then, when the light went up, the secret of these mystifying manifestations was plainly disclosed, for the hands of a little old woman who sat in a

far corner of the room-by far the most innecent appearing person presentwere black with inki-

One thing that has luspressed me with regard to almost all mediums that I have seen and invectigated in their startling lack of originality, The methods that mediums use to impress and mystify dupes today differ in few empontial particulars from the methods that were used by the first mediums who sarang up like mushrooms after 1848 in the wake of the famous Fox sisters.

HE Fox slaters, Margaret and Katle. were the founders of spiritualism as we know it today. They were two much your children of eight and six respectively, who lived on a farm at Hydesvale, N Y To frighten their mother they began dropping apples and making other mmiler noises on the floor of their bedroom, while they feigned alsep. Later they learned to produce the sound of rapping by clover manipulation of their fingers and toos, and in a short time the superstitious country folk imputed supernatural powers to them.

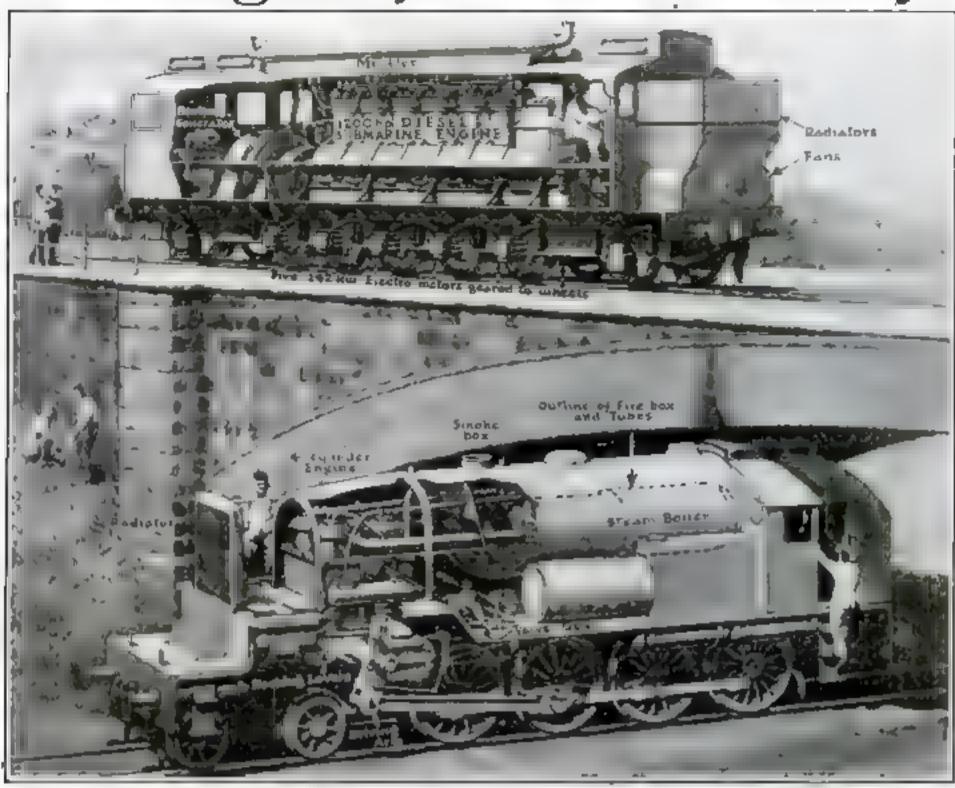
An older married sister saw commercial possibilities in the odd accomplishments of the children, and exploited them widely. That was the beginning of spiritualism, and, although Margaret For made a full confession in 1888, explaining in detail how she and her sister had fooled the public for years, spiritualism has continued to endure, and the number of mediums has in-

creased steadily.

Another point that I have noted with regard to mediums, a circumstance that should give any thinking person pause before accepting as genuine the manifestations he witnesses, is that no "spirit" materialized by a medium ever offers anything that is above the mental level of the medium. All spirits, that is, talk in character with the medhum.

(Continuel on page 152)

New Engines for Motor Railways



Above: Locomotive with Diesel releasing engine and electric transmission, built for the Russian g verment Below. The latest pil-burting rough with steam auxiliary which was designed in France.

By S. W. Clatworthy

of the motor-ship at sea long has suggested the advantage of motor-locomotives, the chief drawback to practical use of the internal-combustive engine on our railways has been its lack of flexibility. In other words, because it is essentially a one-speed engine, it is found incapable of widely varying output of power to meet changing demands. Though remarkably economical on ordinary stretches of road, the motor-locomotive cannot start a heavy train unassisted or cumb a steep incline.

Three of the most recent attempts to remedy this difficulty by auxiliary steam or electrical transmission are pletured here. The locomotive shown at the top has just been completed for the Russian government at the Hohenzollern Works in Germany. It employs electrical transmission, with five driving motors, placed one in front of each pair of wheels.

And her off his long to design the state of the state of

A 1200-horsepower Diesel submarine engine forms the main power plant. The radiators are adequate only in cold weather. In warm weather a cooling tender must be added. While electrical transmission is found to involve a loss of 30 per cent in efficiency, this machine is said to be remarkably easy to control. The other two locomotives both use steam as the auxiliary, the center one being designed in France and the lower one in England. In each case steam, acting below the pistons in the cylinders, starts the locomotive. After the necessary speed has been reached, the steam is used in combination with oil.

How a Cowboy-Aviator Hunts



Breaking a Wild Captive-A Desperate Struggla

Imprisoned in the correl, roped, and bridled, the magnificent outless fights desperately. Singing his white body high in the air is on effort to shalle off his captors. A typical "brouchobusting" scene on the Montena range, where a campaign in on to exterminate wild horses

HE great white stallion snorted, wild-eyed, muscles tensed, his gorgoous mane tossing in the breese that awapt across the want desert of the Colorado Plateau. Behind their leader a shaggy band of mustange trembled in terror.

Out of the mighty depths of the Grand Canyon rose a humming roar that thundered through the spacious silence of the plateau as a great winged creature shot from the chasm at the North Rim and swooped downward, like a giant bird of prey

With a acream of warning the big stallion lunged forward, a flashing streak of white, while the pack of wild mustangs pounded the desert at his heels. Madly they tore across the waste of sagebrush and cactus in a terrified race to shake off the strange menace from the skies.

The pursuer swung lower. Closer and closer it flew, until its great wings cast a shadow over the toming, straining bord. and its roar drowned out the best of flying boofs. Mile after mile the relentless pursuit continued. Now a raw boned more at the year of the band faltered, stumbled, and fell. Now a spotted colt wavered and lagged behind, all atremble. The terrific pace was beginning to tell.

Suddenly the leader reared his white body high, wheeled about, and as suddealy doubted back toward the canyon rim, the other horses following. But the pursuer was not to be shaken off so easily. With hanked wings it cut a sharp circle in the air, and once more the race was on. Reaching the rim the horses turned again, only to find that their canniest efforts to escape were in vain.

And when at last the enemy soured away into the higher reaches of the desert air, it left behind a sweating band of exhausted, trembling brouchos easy prey to the unerring lariate of cowboys.

So ended the most spectacular wildhorse hunt since the days when the Indians and Mormon pioneers in the

Colorado Plateau country began rounding up the untained descendants of the Arabian mounts of the Spanish conquistadors. A most dramatic and thrilling race it was, for in it were matched all the cunning and speed of unbridled horseflesh against the marvel of modern science—the sirplane.

The pursuing pilot in this first attempt to hunt wild horses by airplane was none other than "Chance" Parry, one of the most femous wildhorse hunters of the West, and at the same time one of the most damag of aviators. The new manner of hunting was his idea. From his long experience on the plains he knew that the speediest horses that could be mustared for pursuit would have been shaken off quickly by this fleet wild band. What he did was to prove that the girplans, sweeping so low that he could plainly see the tossing manes and the rolling eyes of the frightened herd, was not to be outdutanced.

So successful was his novel experiment that Chance recently launched a plan of campaign that promises to be a spectacular feature of the West's general movement to capture the untamed bronchos that now roam the plains in such numbers they are looked upon as a menace to the cattle and sheep grazing industry. That the wild horses really are a menace is syldenced in Utah, for example, where several sessons of drought have brought trouble for the sheepman, for it has been difficult to find sufficient grazing on winter range. With thousands of wild horses feeding in unrestricted freedom, the graning has been cut down.

ODAY sheepmen lie in wait for the wild steeds at the water holes. Indeed, it is not uncommon to count an many as 50 dead horses beside a water hole-elaughtered by sheepmen to protect the range. In Montana it is estimated that 400,000 wild horses are running at large, while the number in Utah, Nevada, and Arisona probably will swell the grand total to more than a million. The range grass consumed by the wild herds in Montana alone, it is figured, would support 2,000,000 sheep or 800,000 head of cattle.



A fine herd of wild horses, trapped at a water 40, a menace to cartle and sheep grazing. In the

Wild Horses

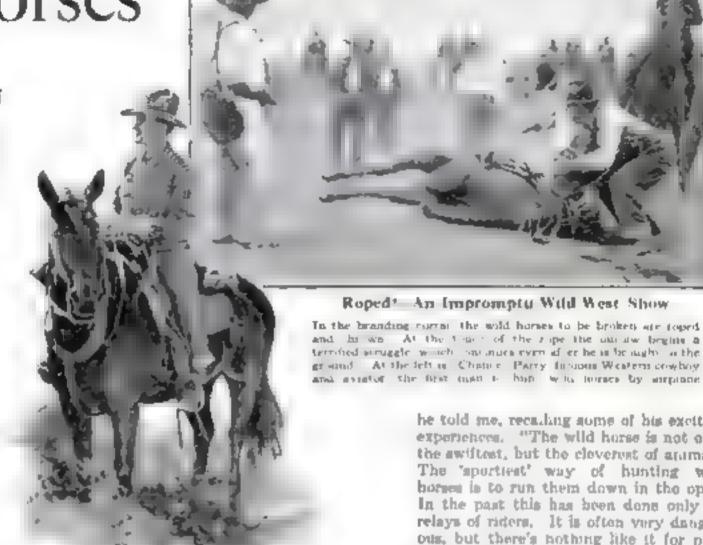
 B_y ARTHUR CHAPMAN

Mr. Chapman is a noted writer of Western stories and verse. He is best known to the American public for his calebrated poem, "Out Where the West Begins"

Chance Parry's plan of campaign is to locate wildhorse bands and to follow them by airplane, holding relays of horsemen in readiness to take up the pursuit when the bronchos have become so exhausted by the chase, they can be captured easily by the cowboys, In all the West there probably is no other man so well fitted to carry out this new method of hunting Wherever the subject of wild horses is mentioned in the Southwest, the name of Chance Parry inevitably figures. His full name in Chauncey G. Parry, but he

is well nicknamed, for the chances he has taken in suddle and airplane have brought him fame, even in a frontier land

PARRY is a typical product of southern Utah, where the hardy Mormon pioneers learned their lesson of sturdiness and solf reliance in the wildest, roughest school in the world. Even in a country where all children learn to ride as soon as thoy can sit upright, Chance's feats of horsemanship as a boy became a matter of comment. The wild horses that he easy roving about the Utah ranges fascinated him. When he was only 10 years old be began to take part in the wildhorse hunts. And when he was at the age when most boys dream of acquiring



a steady-going Shetland pony, Chance was out on wild-horse hunts of his own, riding bareback and matching the speed of the best horses on his father's ranch against the fleetness of these flitting equine shadows of the plains.

Parry now is in his thirtles—a typical keen-eyed, hard-sinewed Westerner of the outdoors. He has hunted all kinds of game in the depths of the great Kaibab forest, and has brought down cougans in the side canyons that lead toward the appalling chasm of the Grand Canyon. He has served with the U. S. Army Air Service in the World War. But hunting wild borses, he says, has brought him the greatest thrill of all.

"It's the greatest sport in the world,"

he told me, recalling some of his exciting experiences. "The wild horse is not only the swiftest, but the eleverent of animals. The 'sportiest' way of hunting wild bornes is to run them down in the open. In the past this has been done only by relays of riders. It is often very dangerous, but there's nothing like it for pure thrill. The only way to do it is to ride bareback, for this not only relieves your home of the weight of the saddle, but often saves you from injury in case of a fall. Such hunting can be done successfully only in relays, for no saddle animal, with a man on his back, can hope to get within gunabot distance of a wild horse."

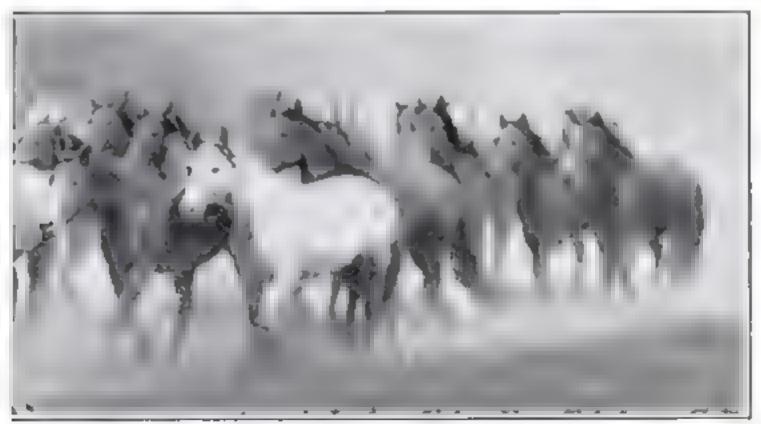
Roped* An Imprompty Wild West Show

THE wild horse of the Western plains has a proud lineage, though in many cases inbreeding and erossing with inferior blood have worked haves with his appearance. Generally speaking, he is a descendant of the first Arabian horses brought to this country by Coronado and other Spanish explorers to assist in conquering the Indian tribes of Mexico and our own Southwest.

Padre Escalante was the first of the

Spaniards to take horses north of the Grand Canyon when, in 1776, he set out to find a route from Santa Fé to the missions of California. In the course of his wanderings be penetrated what is now northwestern New Mexico. western Colorado, and southern Utah, and in these regions he left many of his fine Arabian steeds, some being lost, and others being driven of by unfriendly Indians. These horses formed the pucleus of the wild herds now roaming the Colorade Plateau region, including northern Arixona, Utah, and Nevada. Papling Indians from the North came down and captured horses from the Navajos, Paiutes and other south-

(Continued on page 165)



hole. Mearly a million of these saimals room the Western plains in beads of from six to 39 or compelen to capture them, "Chance" Purry proposes to run them down by low-flying simplemen

Every Day's Work a Gamble with Death



Daring Adventures
of Strong Men Who
Fashion the Steel
in Our Skyscrapers



Per about a half century Adam. Dieht has been etc. In a de atal etc. He rare away for home it berrare as a forman at 13. Now a greate a de atal and atal etc. It be rare a transfer a trans

By Peter Vischer

A THUNDER, to tembardment of air-guns wanded my ears with its deafoning roar. Here and there on the gaunt metal network

that stretched from beneath the sidewalk to 20-odd stories over my head, nimble, sure-footed pygmies acurried about or hung perilously from the edges of the frame. They were piloting buge steel girders into place, matching red-hot rivets tossed to them apparently from nowhere, and driving them home with head-splitting clatter, hauling with fierce strength on the giant wrenches that locked the massive beams, rouring their house directions to the houst runners.

The great skeleton of New York's newest akyscraper was rising bone by bone from a huge pit in the crowded street. All was noise, bustle; seemingly confusion, too. The effect was stirring and impressive—even, I must admit, a bit terrilying.

Adam Duchl, veteran boss of steel jobs, a grizzied, raw-boned glant who is now past 70 and has been handling from and steel for half a century, stretched out a long arm in a gesture that included the whole scene.

"Those boys up there," he said with a wink, while a quissical emile illuminated his weather-beaten face, "they're just joy-riding. It may give you a thrill, son, to watch 'em running around up there like so many monkeys. To them, though, working aloft in just a joy-ride. Our big work-our hard work-we do where nobody sees us-down in the ground where we have to handle beavy tonnage in water, dirt, and loose rock while we set a foundation. That's real work. Once we're above the street, though, it's a romp—and I don't care if you go as high as the Woo worth Building, or higher

"Not," be made haste to say, "that hopping round above the steeples, with nothing but a six-inch steel beam between you and an introduction to the angels, isn't dangerous. It is. There's only one other thing a man can do that's worse; and that's handle dynamits. But most folks have an idea of our work that's just exactly wrong. The higher

the building, they figure, the harder the work. But it's not so. Height we don't mind at all. We're as comfortable 'way up there as we are down here. Steel-workers have level heads. Otherwise, unstead of being steel-workers they'd be selling fish, or something. They're never afraid. They're squirrels, that's what—quick with their hands, and their feet, and their minds. They don't get rattled. When they do fall, you can bet it's because something hit them and knocked them off. Yes," he repeated with a reflective nod, "it's a joy-ride—that's all."

Just Joy Riding ' Seels often are as confect ente was up there as we me

down here they tell you. At the left a group is certain lunch high up on the of New York's howest sky

scropers, with only a steel beam be-

tween them and death. Above:

Reading a finger of steel to the sky di

IT TAKES gruff men to find so blunt a summary for the spectacular circus of structural steelwork; raising a finger of steel to reach for the sky. But that's just what Adam Diehl and the other "boye" of his trade are—tough and hardy as the grim metal from which they shape the towering structures that make our modern cities, and the great bridge spars

over which speed our railroad trains and our motor-cars.

And these men, into whose bodies, into whose very souls has been fused some of the hardness and strength of the metal with which they work-they more, possibly, than the exponents of any other single trade or calling, carry forward the progress of civilization. For the story of our modern civilization and the story of iron and steel are one. Man's progress dates from the day, 6000 years ago, when he first learned to make iron in his crude, tiny smelter. Each milestone in his climb to his world of today is marked by the discovery of some new use for iron or steel. And the men who fit modern steel into our great buildings and bridges are in every sense worthy of the importance that steel has held in shaping the world's history.

THEY have true courage, fine skill, and the love for their craft that is the mark of the real artisan. They, with their splendld contempt for becards that would cause a less hardy breed to quail, may style the more spectacular phases of their work a "joy-ride," but in their heart of hearts they know they skirt widely round the truth when they speak so. For structural steel-working, below ground or above, is no pleasure jaunt, but a thriding, soul-trying man's calling, erammed to the brim with romance, with adventure, with conflict, and with dangers that make herold deeds merely part of the day's work

A few weeks ago announcement was made that construction will begin soon on the argest office building in the world in New York City, north of Grand Central Station. It is to be seven stories in the rock and 50 above the street. Construction is to cost \$19,000,000 and the building is to have 1,350,000 square feet of floor space, more than the great General Motors Building in Detroit, more than the Equitable Building in New York, the world's two largest buildings at present.

Buge columns of steel will be set down

beside Grand Central, each one numbered, drilled with holes, all ready to be stood up and riveted together into the framework of a new marvel of engineering.

Sounds very simple, doesn't it? Quite like the joy-ride that old Adam Diehl described. But wait!

All of those columns—and some of them weigh 60 tons aprece will have to be hauled pust the third rail of the New York Central tracks. Let one of them drop-a short circuit! High voltages transferred in a wink from the power rail to the mighty shaft of conductive steel! Sixty toos made suddenly alive with death-dealing current! A joy-ride, that? Scarcely. Nor am I suggesting merely a territying possibility. For that identical thing happened in those same Grand Central yards not long ago during the construction of a new apartment building on Park Avenue. No one was killed that time. Of the next time, though, who can my?

Compared with such a job, erecting the apper stories of New York's newly projected 65-story hotel, eight feet talker than even so mighty a structure as the Woolworth Building, is child's play, once the foundation is laid. For this and other famous skyscrapers are in their upper stories what the structural steel erector calls "typical"—square, clean-cut work of a kind that the "boys" have performed time and time again. When they get away from the typical, though, their work becomes difficult and

THUS, Adam Diehl, teiling experiences he has had in more than a half-century of steel and ironwork, shook his head grimly when he mentioned a comparatively insignificant structure—the electric tower erected for the Pan-American Exposition of

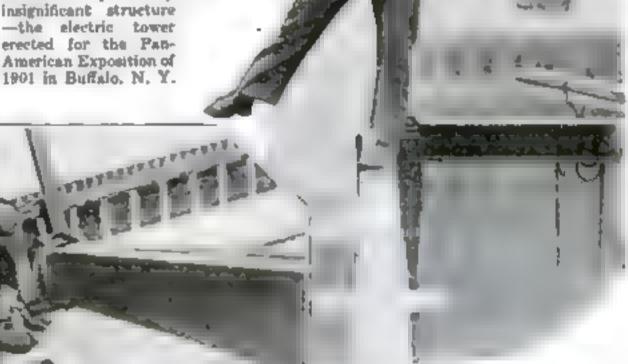
dangerous

"There was one," said Diehl emphatically, "that was a beaut! Narrow, a temporary building, and so mechanically delicate, 475 feet high, and it had to be put up while the wind from Lake Erie blew in on us in gales. I'll tell you the boys had to hold on to that one with their teeth! There were 65,000 turned bolts in it, and we had to rivet in every blessed one of them by hand

"LELL, we got it up without losing a man. Then, after the exposition closed, they decided to take it down again and put it on top of a building in St Louis. That meant cutting out those 65,000 bolts, and taking the pieces down in such shape that they could be set together again. We got off to a good start, and got most of it down. Then one day the wind got to blowing a little harder than usual, and a section collapsed, One of the boys tumbled down in it. He didn't have a chance for his life. Three others, who got caught in the wreckage, were badly banged up, but managed to pull through

"And that wasn't the worst accident I give saw, by any means.

I got an early look at one. When I was a young fellow, breaking in, I got a job on some of



Giving the Crowds a Thriff

Occasionally the structural steel-worker tolieves the motiotoxy by giving the crowds below a real thrill. Such "stunts as this young grant is performing however usually are discountenanced because of their hazards. Most of the structural steel workers wandered to the jobs as boys, lared by its romance its danger, and its many exciting adventures

Spectacular as a Circus

In building and repairing our great bridges, such men as those at the left perform feats that would make any circus and energiase. For them it is all in the regular day's work



As Quick and Nimble as Squirrela

The builders of our towering skywyspecs and great landges are like against by-quick with their hands, their fest, and their minds. They don't get rattled. When they do fall, you can bet it's because mose-thing hit them and imacked them off, or because of had weather's

the Centennial buildings in Philadelphia, back in 1875. I was doing all sorts of odd jobs, learning the business. Now, Machinery Holl and the main exhibition hall had from in them and they were going up without any trouble. But right next to them another building was going up in wood and bricks.

"There were a lot of men on that lob, all busy with their own worries. One day when the weather was bad, all of a sudden we heard a crunching and a grating and then there was the brick and wood all tumbling together Men on scaffolds were falling in with the mess, yelling and bollering so you could bear them for miles. I can hear them yet, and I'll tell you I'll never forget it. The wind had just spilled that thing together and we had to unacramble it to get out the poor devils caught in it. Eightyeight we found, and we laid them out on flat cars and along the street. That was a dismal start for a young fellow, I'll tell

"SINCE then I've seen fellows go down time and time again. And still, when you consider the kind of work the boys do, the casualties aren't so heavy Eight out of ten of the boys are six-footers and over and can take care of themselves. And if you don't believe that, you ought to see them fight. A good many of us live to a fine old age."

Diehl has worked on all kinds of steel construction. He was born in Philadelphia and ran away from home because he didn't like to go to school. He got

odd jobs on construction projects and soon became a favorite with the "punbers," as the foremen are known, because he was strong, active, and energetic, and because he could toos fiery rivets like a champion.

"I GOT into this," he says, "because like most young boys I imagine I was strong in the back and weak in the head. However, I got along. The competition was stiff enough, because in those days you stayed down unless you could lick every man in the gang. But I was a foreman at 25."

In time, Diehl became a structural steel-worker, or bridgeman, and then began a nomadic existence that has taken him to several continents, working on all kinds of construction projecta — buildings. bridges, subways, elevated raliways. and ships. He is one of the best known men in the steel industry, and well he

might be, for he's been at it since before there was steel, since the days when wrought from had to be used. The whole steel industry knows Adam Diehl, and loves him.

Diehl's introduction to the steel husiness was rather typical. Most of the men in it wandered to it as boys. First they were ordinary roustabout boys, apprentices, doing odd jobs around and helping the iron-workers with their tools.

Naturally, they were ambitious and their great ambition was to take the next step and become what is known as "rivet boys."

Now, DALDY youth would enjoy being a rivet boy He is that spectacular young devil who tomes red-hot rivets from a fire to another of his gang who nonchalantly entches them in a pail some yurds away. Here's a true expert's job, for a rivet mused up around the thirtieth or fortieth story can do considerable damage before it lands hundreds of feet below. Because the job is so exciting, it catches the eyes of young apprentices, and they spend many hours practising tossing and eatching rivets.

Eventually apprentices become full-fiedged bridgemen or atructural steel-workers. Nowadays, in such cities as New York, Jersey City, Newark, Paterson, Atlanta, and Cincinnati, this means \$12 a day for an eight-hour day, with double pay for overtime. (Rivet boys, if they're good, get eight dollars a day, which shows the asteem in which they are beid in the steel industry.) Bridgemen do all kinds of work, from setting foundations a hundred feet below ground to making connections of steel beams hundreds of feet in the air.

In time, bridgemen may become "pushers" or foremen, when they earn as much as \$100 a week, sometimes a little less, sometimes a little more. But at heart they're always bridgemen.

"Fridges are the best," says Diehl.
"You work on a bridge and all is happy.
You don't have to argue with concrete
men or carpentars, or with cops, architects,
superintendents, owners, inspectors, or
anybody else.

"Sometimes, of course, bridges are no cinch. I remember once when I had just gone on vacation. I had had one day and three hours off when I got a hurry call to hop out to Ohio. I got to Zanewille and found the place under water. It was the time of the Dayton flood. Thousands of people were marconed, their homes wrecked. They were without shelter and warestarving. They had no way of escape, for there was just one bridge left from Coshocton to Wheeling Funny thing, too, that one surviving bridge was coment, cracked at that; and condemned to destruction.

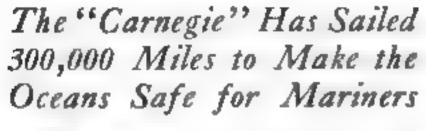
"YOU can bet they needed bridgemen, and they called them from places all the way from Frisco to Halifax. From all over the country they came to Zanesville to try and get trains and food and medicines and shelter out to women and kids who were going all to pieces from fear and hunger and exhaustion.

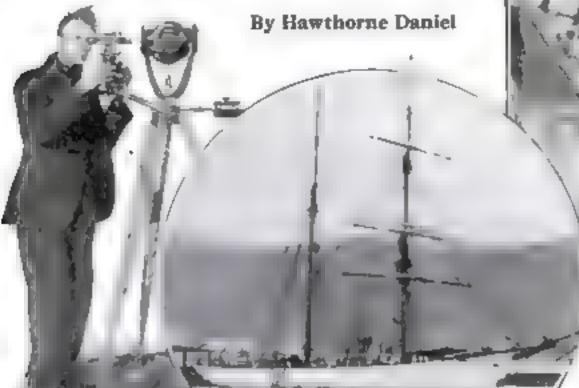
"There was real work done there. We didn't have any decent tools and we didn't have steel. We managed to get



Perched High above New York's Waterfront Theirs is a thrilling soul-trying calling that demands level heads and courage. Only one job is more dangerous—handling dynamits

The Strangest Ship Afloat





Ashere at Iceland

Taking observations with a marine our racting compass at Engen levisod. Measurements of compass variations made by the Carnegie have saved many wrecks

D. C., is the strangest ship in the world. At present she is laid up, with her decks hidden beneath a tentike structure that covers her from how to stern. But within a few weeks she will set out on the latest of a series of cruises around the world, engaged in one of the most unique missions on the seas.

The ship is the Carnegis, a 165-foot brigantine, owned by the Carnegie Institution of Washington and operated by the Institution's Department of Terrestrial Magnetism. Her task is to voyage all over the navigable waters to make a magnetic survey of the oceans, to cruise in search of the mysterious magnetic and electrical phenomena that appear to occupy all space, that attract the needle of compasses, that cause the brilliant displays of the aurora boreads, that produce the radio bughear—static—, and that assist inbalking the waves sent out by radio stations.

In her 16 years of voyaging she has passed through many thrilling adventures. She has been within 600 miles of the North Pole, and is the only ship that ever circumnavigated the South Polar regions in a single season. The whole nautical world is indebted to the scientists on this little wooden ship, which already has sailed 300,000 miles.

THE Cornegie is like no other ship ever built because she is put together with practically no iron nor steel in her. It



Learning Secrets of the Air

One of the remarkable instruments used aboved the Cornegie to determine electrical varieties in the atmosphere above the sea a study of sucressing practical value to radio communication over land and sea

was extremely important that a ship investigating the world's magnetism carry nothing to deflect the instruments

She is made of wood fastened with locust treenails, copper, and bronse. All rigging is of hemp, anchors are of bronse, and she has no anchor chains, using instead great manila hawsers I I inches in circumference. The chairs on board are put together with bronse fastenings. The cook uses aluminum and copper kettles.

World Mariners of Science

Above, at right. Dr. Louis A. Better hand of the magnetic curvey is shown observing magnetic declination with a correcting compass. Captain J.P. Ault master of the Carneges, stands beside him. Picture at left shows the Carneges at Mauritus Island Africa. This remarkable wooden brigarities has practically no iron nor steel in her. She is fastened together with tremails, brouse, and copper

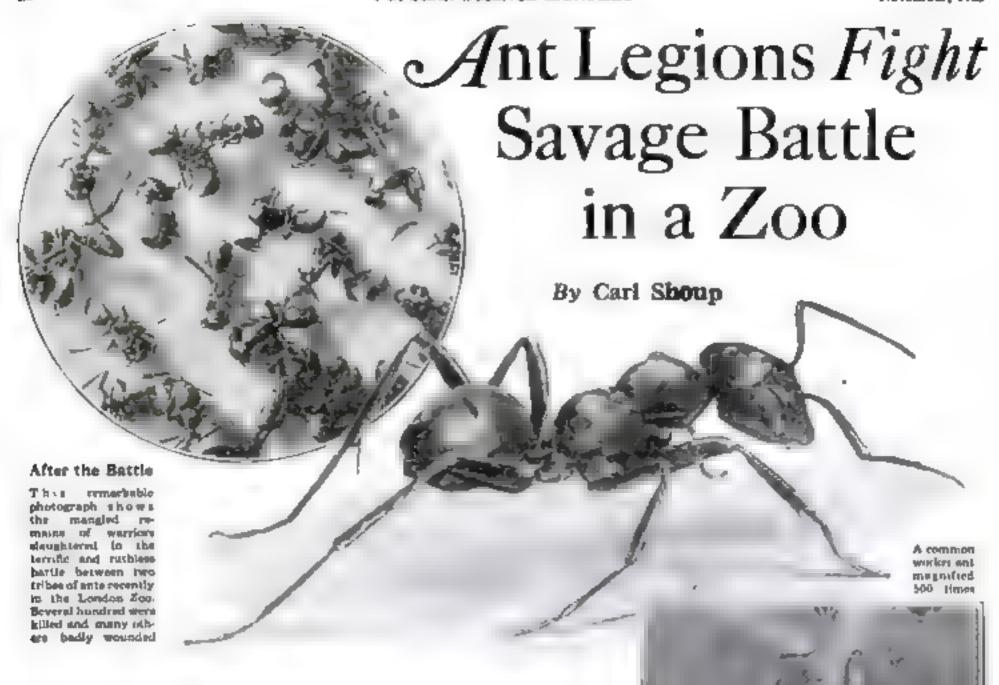
If the sallors carry pocket-knives aboard, they must throw them overboard before sailing. Every bit of metal must be tested carefully with a magnetic needle before it is allowed on board.

While the Carnegic is a sailing vessel, she carries an auxiliary motor and in this, steel could not be eliminated entirely. The specially built engine is made of brass, bronze, and copper, but the pistons and carns are of steel.

AS THE ship wanders from North to South Pole, the scientists on board determine the variation of the compass. This information, used in charts prepared by the United States Hydrographic Office, in collaboration with the British Admiralty and the French, Japanese, and German governments, has saved hundreds of sailors from shipwreck.

Compasses, as generally is known, rarely point exactly to the north. Because the earth's magnetic poles are approximately 1200 miles from their respective true or geographical poles, compasses may point in any direction, depending upon where they are used. The difference between true north and the direction indicated by the north end of a compass needle, is known as the "variation of the compass." This slways must be determined by a navigator to find his real position. The calculation is compliexted, because the magnetic poles and the magnetic lines of force connecting them are shifting constantly and not in a regular manner

In the cruise that now is planned, the Cornegic will cross many hitherto unstudied regions, check up on earlier data, and gather new information about the electrical phenomena of the oceans.



London Zoo recently. The keepers turned a thousand or more animals loose, urged them to attack each other, and before the mélés was over, several hundred had been killed and many others badly wounded. The London newspapers carried running accounts of the fight; excited spectators came to view it.

Why was such a thing allowed? Well, you see, all the "animals" were enta-That made it pretty safe for the human onlookers. But if you think that the battle was any less ferocloss or deadly than a combat between tribes of wild-cats or herds of elephants, you are mintaken. The ant, when properly aroused, can give any animal lessons in ruthlessness.

The most remarkable thing, however, was the way in which the opposing armies planned their campaigns and conducted their attacks. It was proof of that illuminating remark made by the great English naturalist, Sir John Lubbock, when he said, "Of all animals, the ant is nearest to man in all his actions." The remarkable intelligence of the ant, which makes him one of the most versatile creatures alive, has long aroused wonder, and here is a demonstration that he can use his brains in the heat of battle as well as in the calmer days of peace.

IT ALL started on a bright Monday morning, when one of the keepers at the Zoo placed a little wooden chip, not on an ant's shoulder, but over the most that separated two ant colonies—an old one that had been there for three years, and a new one just arrived. The chip served as a bridge, and for the first

time made possible communication between the two nests.

A member of the old colony got curious. He assaled across the bridge and penetrated into the new nest of ants. He never came back

That meant war, the old ante decided. But they did not lose their heads and dash pell-mell across the bridge, only to be swallowed up in a possible ambush. Instead, they chose 10 of their best warriors and sent them out as scouts. These daring ante-crawled across the chip of wood, with the muddy water of the most measuing them from below, and crept cautiously into the enemy's territory.

THEY found nothing. All the new unto were hidden away in their nest, unaware of the catastrophe impending. The wire scouts went back home.

An exested council of war must have followed, for in a few minutes there usued from the old nest an imposing array of warriors, marching in ranks as orderly and well defined as the Macedonian

phalanx. A few scattered ante running alongside threw the white sand up into little mounds that could serve as fortifications in case "earthworks" were needed for defense. Then the whole band, now greatly augmented, awarmed across the bridge.

A lone ant of the new colony was out taking the air when he saw the hostile band come pouring toward him. He was



A Herd of "Cows" on the Dairy Farm Corporar ents tending their "over"—the aphids of plant lice—from which the ents learned to obtain excet "caille" by stroking them with their antennal

brave, but he also was wise. Therefore he hurried back to the nest to warn the others. In a few seconds all his comrades were streaming out to the attack.

The carnage that rollowed was terrific. It sounds almost unbelievable, but the fight hasted for four days and nights.

On one occasion an armistice was arranged but it lasted only a few hours. Evidently the terms were broken by one side or the ARMY Formation, Trenches, Truces, Spies, Prisoners, and Strategy Mark Strange 4-Day War-Facts about these Amazing Greatures

other, for the battle was resumed, and more wounded lay quivering on the white sand or floating helplessly in the water beneath the bridge, while dead bodies lay strewn around everywhere. With their hig mandibles, the warriors plashed at one another in individual combat. They tossed the weaker ones into the most; or, failing this, cut off their opponents' limbs and left them helpless.

BY THURSDAY afternoon the invaders from the old colony had been driven back across their bridge and practically annihilated. Their fortifications were useless, for the rout was complete. The new ants took some of their captives for slaves, killed the rest, and then went back home. The workers cleared the dead from the field, and all was peace.

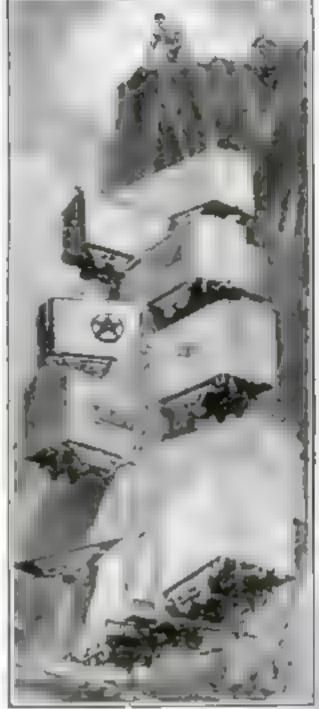
The intelligence and power of organization shown by the ant in time of war is no less marked in time of peace. This amazing little animal not only is an efficient warrior; he is also an architect, a mathematician, a perfect numerial, a professional strong man, a farmer, a doctor, and an undertaker of distinction. He displays teamwork and a force of will, equaled only by his fondness for gay life (including, also) intoxication) and sports. Doctor Hermann Eidmann, famum entomologist, of Munich, Germany, assures us, too, that the ant can talk!

Consider, first, his skill as an architect. In East Africa may be found tall, slim towers of earth built up by the white ant, or termite. Some of these towers are 20 feet high. Imagine a creature only a quarter of an inch long constructing a piece of architecture 20 feet in height! It is as if the ancient Egyptians had built 12 pyramids, one on top of the other. And the Egyptians at least had primitive



A Skifful Home-Builder

This is the home of a corporate ant, an insect that is an import architect and builder



The Strength of an Ant.
In a laboratory test a little field out held in its pawe a weight 3000 times beavier than intelf. To equal that exploit a man would have in dangle from its jawa.

eight freight cars loaded with iron

tools, while the ant works with nothing except the limbs that nature gave him.

In THE mountains of Pennsylvania are found some of the largest "ant cities" in the world. Most of them are built under ground, and the biggest one covers 30 acres. Think of 30 acres of antal Think of the bewildering complexity of the subterranean passageways, and you will wonder how an aut ever finds his way back to his starting-place. Yet be does, by some mysterious sense of direction

The ant is the most efficient builder in the world, for he carries all his "tools" and material with him. For instance, he can make a sort of millboard for his home by chewing up certain regetable matter and causing it to stick together by rocans of a glue secreted in his glands.

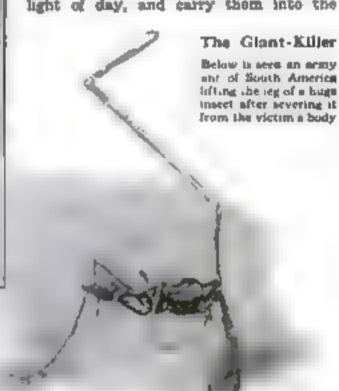
Perhaps the most striking demonstration of the ant's intelligence is afforded by the manner in which he builds a shelter among the branches of a tree by "newing" leaves together. The full-grown ant can spin no "thread," but the larva can, for it has to-make a cocoon. So the adults fetch up their larvae, which have been spinning their allk cocoons. A number of worker anta pull the edge of

two leaves together. An adult holds a larva in its mouth, pokes the latter's bead down on the leaves, and the little larva begins to emit silk at a good rate. The ant holding it draws it back and forth across the two leaves, and since the silk stacks and hardens almost immediately, a large number of such contacts have the value of stitches, and the "sewing" process soon is finished

The ant was the originator of the cooperative institution. He knows more about teamwork than any 40 football

coaches combined.

JUST for callous curiosity, take a spade some day, find an ant hill, and cut it clean in two. Then notice what happens. For a few minutes the little animals will run around in desperation, but soon, as if some mysterious voice were commanding them, they will stop their simless scutterings and get down to work, each doing the task nearest at hand. One will pick up the pups, which cannot stand the light of day, and carry them into the



deeper caverns; another will seize a grain of sand and start to repair the nearest breach; still another will carry away any debris that has fallen in the tunnels.

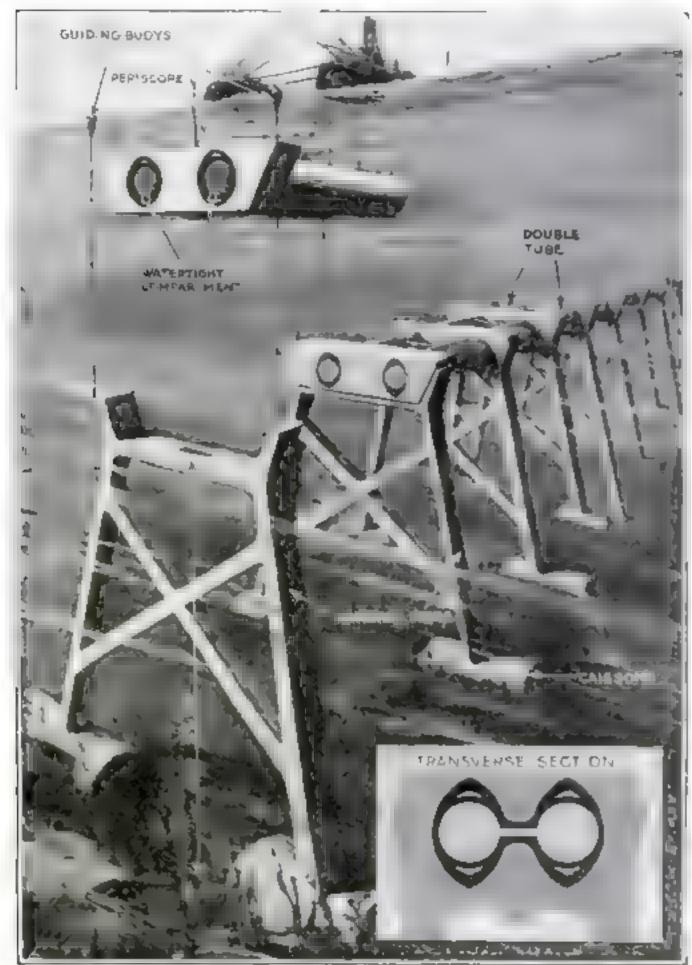
And the most peculiar thing about it all is that apparently no one ant directs the work. There is no leader, no boss. Yet they work like a machine.

"HIS spirit of co-operation extends even to the fallen brothers, as exemplified in a rather laughable experiment once made by Sir John Lubbock. Sir John took a few unfortunates, made them drunk on hard liquor, and put them on a highway where sober anta were burrying back and forth. The aober ones were quite excited at this disgraceful spectacle, and probably somewhat scandalized, but they picked up the drunken ants and took cars of them, nevertheless. To be truthful, one thing must be noted: Some of the drunken anti-were strangers. and these the sober rescuers ducked in a Their friends. pool of water near by they took home to miety. One must discriminate, of course.

Did you ever think of the ant as a mathematician? Not that he delves into

(Com nurd on page 173)

Submarine Trains to Run on Stilts?



A French engineer's plus for building an underway route between France and England across the English Channel by michoring gigantic concrete piers to the seabed as a foundation for a two-tube rankway

Engineer Plans Channel Tunnel Built on Great Concrete Piers

FOR more than a century, one of the most fascinating problems to the European engineer has been the building of a tunnel under the English Channel, to link France and England.

One of the latest schemes is that of a Frenchman, Commandant Vayrier. He proposes that, instead or boring a tunnel through the bedrock of the Channel, a succession of great reinforced-concrete piers shall be anchored to the sea bottom by means of strongly ballasted causens. The piers would be sunk 340 feet from the surface. Once the piers were anchored eccurely, Commandant Veyrier's plan calls for a doubletube railway laid upon them, a section at a time, and fastened firmly to the supports, as shown at the left.

At the end of every section of the tube railway would be a watertight compartment similar to the watertight buikheads with which all modern vessels are fitted. These compartments would insure a greater amount of safety in the tube, since if one part of it were flooded, the rest could be abut off immediately. Each tube would hold only one railway line—one for eastbound and the other for westbound trains.

Another engineer's plan, submitted to the British Houses of Parliament not long ago, was to bore a tunnel through the bed of the Channel. This tunnel was to be slightly higher at each and, aloping downward perhaps a quarter of the distance, then slightly arched across the center. This was planned so that, in the event of enemy invasion, the tunnel could be flooded from either end.



At earlier scheme for subgravine transportation under the English Channel. This is a double-tube trimed, built with sloping ends and a slightly arched center. A control mechanism at each end would enable either France or England to food the tunnel in case of an invasion by an enemy

Will You Have?

Whether They'll Be Tall, Short, Fat, Thin, Sturdy, or Weak Now Can Be Told with Surprising Accuracy

By G. B. Seybold

ILL the new baby have brickred hair like his father? What
chance has be for genius? Is
there any lurking possibility that he may
inherit insanity, tuberculosis, or other
dread disease?

Twenty years ago such questions about an unborn child would have been dumissed as futile. Today these and scores of other questions concerning inheritance can be answered with a startling degree of accuracy.

The other day in the Psychopathic Laboratory of the Municipal Court of Chicago, two unique machines were installed that seem to possess the amazing function of forecasting heredity. With a knowledge of the traits of your parents and grandparents, you may set the disks of the machines, give them a spin and read instantly the probable traits of your children, based on the latest theories and the known laws of heredity

These machines, under the direction of Judge Harry Olson, Chief Justice of the court, were designed by Dr. Harry H Laughlin, an expert on augenics and heredity Their first purpose is to determine how largely heredity is responsible for crime, and already they are being applied to practical advantage.



Amazing Machine Tells What Children May Inherit

Chief Justice Rerry Ottom, of the Chicago Municipal Court, with the remarkable machine invented inforecest traits that children inherit. In the center of the device are two rows of spools. The spools on one side represent the 34 chromosomes, or agents of heredity, contributed by the reather. The other 34 represent those contributed by the father. Possible combinations of traits that the children of these parents may inherit are listed by spinning the spools around

But in addition to determining responsibility in crime, the machines demonstrate graphically and understandably, many of the other mysteries of human

One device consists of an upright grooved board covered with glass. Lead pellets, representing children, are dropped into the top and full through various sets of grooves, each set representing a generation. The distribution of the pellets shows how children may be divided in succeeding generations in regard to vari-

our traits. If there is an inheritable disease or other taint in the family, for example, the percentage of those affected in each generation will be shown.

The other machine is based on what are known as chromosomes—mysterious, rod-shaped, microscopic particles in our bodies that acience has discovered are the agents of beredity. Every living species of animal has a definite number of chromosomes in the nucleus of each of its cells. Man has 48.

A human cell is so small that there are 70,000,000,000,000 in a cubic inch of blood. Yet stored in each of these tiny specks is a wonder box of human characteristics. In fact, chromosomes often have been likened to a tiny box filled with a number of traits. The manner of the chromosomes' meeting (24 from the mother and 24 from the father) determines the characteristics of the children.

THE possibilities for combination of tracts are tremendous, because not only do the chromosomes link up in different ways, but their contents interchange. More than 6000 definite human qualities have been named so far. When all of the chromosomes shall have been identified, the estimated number of traits possible in human beings is expected to exceed 1,500,000.

On the other machine, a row of 24 spools at the right represents the 24 chromosomes contributed by the father; a similar row at the left, the chromosomes of the mother. By spluning the spools, the possible traits of the children may be determined

Different traits assert themselves in different ways. Some are called dominant, which means that they will assert them-



Three Sets of Twins in Three Generations

These three generations of twins, who live in Omaha, Neb. offer striking evidence that the tendency to produce twins is inherited. Strange to say all crickense their buthday within 10 days of one mother. In the center are Alton Avery and Mrs. Alta Avery Voorbees twin brother and aster. It years old. The two women at the oldes are Mrs. Jeanse Avery Robb and Mrs. Josie Avery Haman. 31-year-old twin daughters of Alton Avery and the children are Jean Avery Robb and Bonnie Avery Robb, three-year-old twin daughters of Mrs. Robb

selves over any trait of a contrary nature. A dominant trait will appear in all children. For example, if a father has bendness as a dominant trait, all of his boys very likely will be similarly bald and no hair tonic on earth can prevent it.

Recessive traits, those that are weaker and tend to disappear, on the other hand, may skip one or more generations only to reappear, in which cases usually only a small number of the family are affected.

It is because of this that marriage of first cousins so often is discouraged. Having chromosomes packed with common traits, the union of cousins intensities the possibility of the bad traits affecting their children.

IF THE ancestry of countrs is fine and free from bad traits, no possible harm can result from their marriage, is the belief of many sugenuts today. Doctor Douglas P. Murphy, of Rutherford, Conn., has been observing for many years a family in North Carolina in which there were seven marriages between first cousins following direct lines of descent. He reports that no effect can be noticed detrimental to the health of the children, Mental deterioration, physical abnormality, and lowered vitality, said to result from such marriages, occurred in no instance

The laws known as the Mendelian ratio, that explain the distribution of dominant and recessive trasts, really are laws of chance.

A very tall man marries an unusual y short woman. His tailness damingtes her shortness, and all of their children are tall. But while each member of this second generation is tall, each carries within him chromosomes for producing short children as well as tall ones. If one of the second generation has four children, one of these probably will be tall, one very short, and two tall-short or medium. The extremes of this generation "breed pure," That is, the tall child will have only tall children, the short one only short children; but the two with mixed traits each produce one tall, one short, and two a combination of both trasts. The little lead pellets dropping into grooves of the new heredity machine, falling where they will through

chance, show how this surprising ratio works out

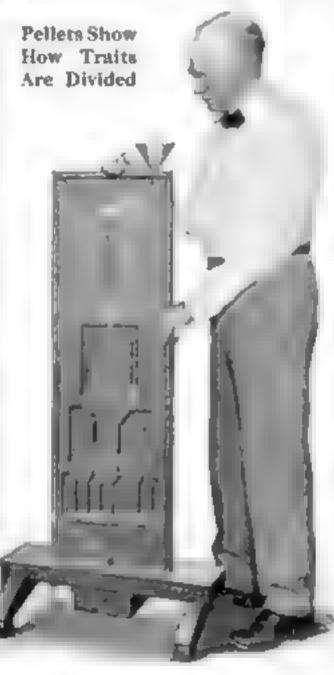
THE operation of each machine is based on a previous knowledge of what traits are heritable, obtained by long experiment with lower animals and study of family histories

Bodily build, for example, is clearly inherited, as is the color of the skin, eyes, and hair. Red hair is dominant over dark. Dark eyes are dominant over blue or gray ones, dark akin over fair.

More remarkable is a recent interesting conclusion that your weight is hereditary as well as your height. Mrs. Jones, who taxes the scales at 210 pounds, complains, "But I don't eat as much as my husband, and he stays thin " Doctor C. B Davenport, director of the station for experimental evolution of the Carnegie Institution at Cold Spring Harbor, N. Y., explains that Mrs. Jones probably has ancestors who passed on to her the quality of turning food into fat. "Children of two thin persons," says Doctor Davenport,

"never will grow fat. Pat persons, however, may have children who always will remain thin."

Differences in sex have been found to be determined by heredity, but rules for its behavior have not yet been found. It is known from observation that through certain lines of descent the girls outnumber the boys, or vice versa. Doctor Clarence C. Little, who has made a special study of this, tells us that more boys than girls are born when the parents belong to different European races than when they belong to the same race. But exactly what proportion of children of any two parents will be girls and how



Another of the heredity machines invented by De Harry H Laughtin sugeries expert. Lend pellets representing children are dropped into the top of an apright proceed board. Each set of grouves represents a generation. The distribution of the falling pellets indicates how children may be divided by trade in succeeding generations.

many boys, cannot yet be determined.

A tendency to produce twins has been shown to be inheritable. Doctor Davenport found that the fathers of twins are about as likely to belong to twin-producing famines as are the mothers of twins in other words, that twins depend on the heritage of both parents.

HI'NT up the family records of the otd-timers, those who lived to a ripe age of 90 or 100 years, and you will find evidence that long life is another inherited trait. The best assurance of long life, advises Prof. Raymond Pearl of Johns Hopkins University, after long experiments, is to pick out long-lived.

parents and, before that, grandparents.

We all are wound up like clocks. Professor Pearl explains, some for short and others for long penods. Your length of life depends largely on whether you have a strong and vigorous constitution, and this is determined by the combination of traits handed down to you.

Of course, the fact that you are wound up for 90 years doesn't mean, necessarily, that you will live that long. An aight-day clock may fall off the shelf on the second day and stop ticking; you may sink in a pond while swimming, and stop ticking, too. Or, if you live rapidly and strenuously, as did Theodore Roosevelt, you may have a more interesting time, but will use up your alloted period and die earlier

Doctor Pearl based his conclusions partly upon experiments with banans or fruit flies, whose life cycle has been found to be extraordinarily similar to that of man. A day in this fly's life is equal to a year of man's. At 90 days the fly is as decrepit as a man of 90 years. Watching the length of life of these flies through successive generations, convinced Doctor Pearl that heredity is the dominating influence in longevity.

He tested the affect of speed in living on four aloino rate kept in a revolving equirrel cage. The average age at which these hard-working rate died was 29.5 months, while three rate confined in stationary cages attained an average old age of 40.8 months.

ALONG similar lines, Prof. M. P. Guyer, of the University of Wisconsin, announced recently after years of experiment that it was possible for mothers to transmit resistance to disease to their children. By inoculating successive generations of rabbits with germs of typhoid fever, he said be was able to develop in their blood an anti-body that the mother transmitted to her offspring, making them immune to the disease. Rabbits of the fifth generation were able

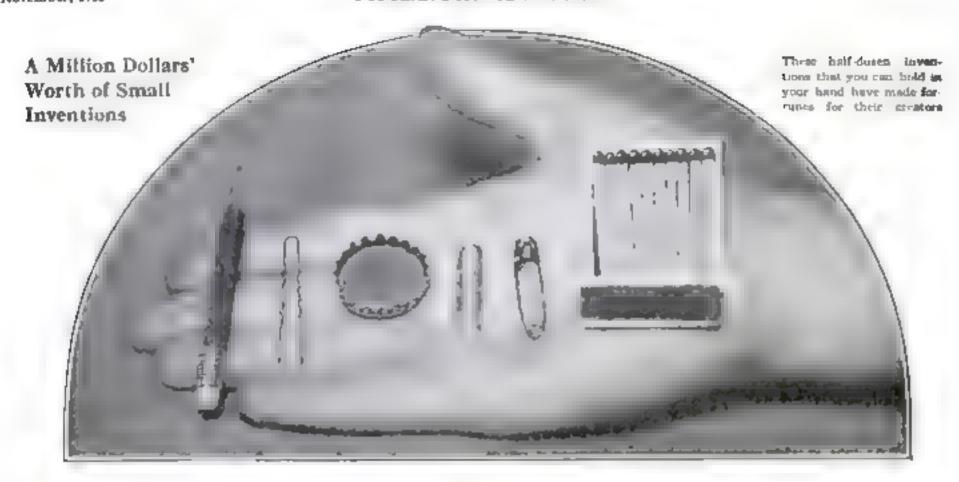
to withstand 50 or 40 times as many typhoid germs as the original rab-

Malformations and weaknesses, tinfortunately, are heritable, science tells us.
Even worse, the majority of those so
far investigated are found to be dominant
traits. Extra fingers or toes, union of
fingers and toes, a white lock of hair,
cataract of the eye, drooping cyclids,
night blindness (inability to see a faint
light), color blindness, defective eyesight,
scaly skin, deficiency in sense of smell,
toothlessness, abnormal tendency to hemorrhage, very small eyes, certain forms of
deafness, fit. Vitus dance, syphilis, and
epilepsy all are passed on through
chromosomes.

ANY mutilation or destruction to a part of the body during a lifetime, either through accident or disease, of course is not passed on. If a man loses a leg in a railway accident, his children will have two good legs just the same. Certain breeds of dogs have had their tails clipped abort at birth for hundreds of generations, but the new-born puppy wags a tail as long as the one his ancestor had centuries ago.

Heredity often is blamed for diseases

(Continued on page 140)



Why Simple Inventions Have Proved Most Profitable

Even the Safety-Pin Made a Fortune-Everybody Needed It

A MAN of inventive turn of mind spent an afternoon on the golf links. He watched each player, before he drove off, take a handful of damp sand from a sand-box on the teeing ground, kneel, and fashion a more or less symmetrical mound of sand upon which to perch the ball. It seemed a mussy, bothersome process, and it had to be gone through 18 times on each round of the course. There must be a better way.

He thought it over inventively. The result of his thinking was a patented golf ten consisting of a pointed pin of light wood with a slightly concave head.

There is nothing starting about this invention. The tee is not much more in effect than a glorified carpet tack. It is one of those simple but ingenious things that "anybody might have thought of." But golfers buy it. Several million have been sold. There was a ready-made demand waiting for the novel little tee, and its retail price is so low that almost any player is willing to "take a chance" and give it a trial.

Another man of an inventive turn of mind naw London nursemaids pushing baby-carriages along the adewalks. He decided to invent a motor baby-carriage He did invent one, and patented it. The nurse stands on a platform behind the carriage and pilots it along at a disry speed of five miles an hour

This motor baby-carriage is a much more complicated apparatus than is the little golf novelty. It cost more in time and effort to perfect and to manufacture, and it costs a great deal more to buy it. Yet it is extremely unlikely that its

By Arthur Grahame

inventor will reap nearly as large a financial harvest as will be gathered by the inventor of the simple little golf tee. There are even more babies than there are golfers in the world, but only a few parents are able and willing to invest in motor baby-carriages.

If you want to make your inventive ability pay you big dividends, invent something that great numbers of people will want and will be able to buy—something that will do away with or lessen some petty annoyance of ordinary life, and that can be manufactured and sold cheapty.

Many of the most profitable inventions have been extremely simple—among others, the safety-pin, "Mrs. Potts" flat-iron with the detachable handle that stays cool while the iron gets hot, which made a half-million dollars for its inventor, the crinkled hampin that stays put in a woman's hair, and Eskimo pie, that comparatively new hot-weather delicacy that earned a big fortune for the man who patented it. A big demand was waiting for every one of these inventions

"I HAVE found that a much larger consideration can be secured for an invention if you can prove that a market exists for it," said a professional inventor of small articles, when I asked him what, from his 20 years of experience, was the first requisite of profitable invention.

"The first step in invention, if one has no particular invention in mind," be went on, "is to examine various articles in general use and see if an improvement can be made on one of them—an improvement that will make the article do better work, and that will make it less costly"

"I DRIFTED into the business of invention during a long elege of ill health," another inventor told me. "Trying to find some way of passing the time, I bought a guitar. I soon tired of merely strumming the chords and playing a few number exercises, and devised a new method of stringing that, to my surprise, made it possible for me to play popular sire on the heretofore rather limited musical instrument. I secured a patent on my improvement, and before long two manufacturers were paying me substantial royalties.

"After I got back my health I devised another musical instrument, a combination of the mouth harp, or harmonica, and the nither, the tune or melody being played on the harp while the accompaniment was being picked out on the strings. Local capitalists financed this invention and we soon had a prosperous business, which was under my management. And from that time I have devoted myself exclusively to invention."

Another inventor explained to me a system of marketing his products that he had found profitable.

"Often," he said, "instead of offering an invention for sale, it is more profitable to the inventor to organize a local company to manufacture it, taking stock and an

(Continued on page 142)

What a Junkman Has Learned about Your Car

The Carelessness of Drivers Brings Him a Fortune



By Edgar C. Wheeler

AT LEAST a million and a half of the seventeen-odd million motor-cars counted in the United States a year ago, have vanished from the road. While some three million new cars have come glistening from factories to take their places, this vast weather-beaten army of 1,500,000 vehicles—more than enough to form a

single line clear across the continent has passed silently and mysteriously into obligion

oblivion

Where have they gone and bow? Have they simply been worn out and thrown into the junk heap? Are they represented by the tragic derelicts you occasionally see rusting and rotting away in some littered back yard or vacant lot? Just what has become of them, anyway?

On New York's upper East Side, near where the Queenshore Bridge throws its apan across the East River, there is a cavernous brick building where rules a swarthy giant of a man. If you should have occasion to visit this place, you might believe you were stepping into some modern farry story as grim and remantic as any tale of giants of old. For you would find this giant prospering amid huge heaps of the bonce of vanished motor-cars. He would tell you, with a cigar butt in one side of his mouth and a

FRANK says:

"If you could see all the worn bearings, gears, and frozen pistons that I do, you'd soon understand how important it is to have your car well heeled with high-grade oil. The poor stuff simply turns thin when it gets hot

"Plain carelessness of drivers runs at least a million motor-cars every year. Reckless speeding, overloading, failure to learn how to drive correctly, and neglect of essentials such as lubrication, are the things that send cars to the junk heap—and I profit."

smile apreading across the other, of the strange fates that have brought automobiles and motor-trucks by the hundreds and thousands there to his grim castle of wreckage. And he would tell you the secret of where the autos go:

"MOTOR-CARS don't wear out; we chop 'em up into hash!"

The name of this up-to-date giant is Frank—simply Frank the Auto Wrecker (nobody would know whom you meant if you called him Frank Palecek). And it is on the very fact, as stated by him, that motor-cars never wear out—never entirely—that Frank the Auto Wrecker has built a comfortable fortune within the last 10 years. He is one of a few aggressive and successful men throughout the country who of late have established a thriving new industry—that of "chopping up" used cars and reselling their parts for what cash they will bring.

Where Old Cars Go

A corner of the "honeyard" showing Frank the Auto Wescher stending bonds piles of storring-wheels wheel bases, and life riess

Frank's business card says that he can supply you with "anything, from a crank handle up to a tail-lamp." In his three wrecking plants, one on the East Side and two across the river on Long Island, he has in stock the parts for 400 different makes of cars. He stores anywhere from 30 to 300 cars at a time, waiting for the alaughter. He has bought out-

right as many as \$126 cars at once. The vast heap of automobile "bones" piled in the rear of his building is a jumbled, unsorted mass of springs, steering-posts, transmissions—every item, in fact, that goes into the making of a motor-car.

On the floor in one corner is the rear end of an old Bena car of 1910 vintage, weltering in its own greass and oil, undergoing the "hashing" process.

Scattered about it are a score of nute and bolts of as many sizes. The walls of a dark passage leading into the "bone yard" at the rest are fixed with box-like compartments, each bearing the name of a particular make of car, and each containing an assortment of parts for that make,

A CUSTOMER comes in, a mechanic from a hear-by garage. "Frank," he says "I want the aluminum crankcase from that last sedan you got out there in the lot. Are you willing to break 'er up?"
"Sure," says Frank. "You can have it
for \$29." The mechanic pays down the
cash and the deal is closed.

ANOTHER customer—thus time a motorist. He wants a set of gears to replace the ones he has just stripped. Frunk goes to the cupboard marked with the name of the man's make of car and pulls down a set of gears that shows very little sign of wear. "Just the thing," says the motorist. "If I bought this set

new. I'd pay twice the price."

Thus, bit by hit, does Frank dispose of and profit from the care that have seen their last days on the road. The story of his own rise to fortune offers a vivid allustration of how pleasure care and motor-trucks disappear from sight by the million every year. Ten years ago Frank was in the trucking business in a small way and the business wasn't prospering. He was sking out a living with a single truck, and he had run that truck hard for seven years—so hard, in fact, that it had seen its best days. Whenever he went out on a job with it, he couldn't be sure of getting there and getting back.

Frank's ready cash was low He didn't have enough money to buy a new

truck, but he had an idea.

"I'll chop this old thing up," he said And he did. Old and wheesy as the truck was as a whole, some of its parts were still in good running order, and he sold them for \$25. With this capital in hand, he went out in search of more motors to make "hash" of. In a storage garage he found a truck that was held for rent, and he bought it for four dollars.

THAT was a bargain, and it gave him a real start. Selling the good parts, buying other care, selling the parts, buying more care—by this method the business grew, little by little, until it eventually brought him financial independence. He never keeps books nor price lists; but he knows every part of every car and what it is worth on the market.

"I've learned," Frank, "that maid there lon't a mingle part of a car, no matter how old it may be, that isn't worth something. The working parts that still are good always can be used to repair other cars: those that are worn can be soid for acrup. The leather in the upholstery goes into making shoes and pocketbooks, the bair atuffing always is wanted by uphoisterem. Assorted nuts and bolts I sed by the barrel to garage men. I even sell the old oil and grease—to the scaptnakers."

Meanwhile, from his daily observation and study of his piles of chopped up cars, Frank the Auto Wrecker has gamed a vast knowledge of the

ways of motorists and why their cars leave the road to fall under his choppingblock.

"The average life of a car," he said, "is about five years. With some cars it is only two years. If at the end of that time a car is overhauled completely, it may last three years longer.

"Why don't care stay longer in the running? There are a number of good reasons, but the chief one is poor lubrication—not only lock of oil, but lack of

good oil.

"Just the other day a fellow came in bern and sold me has five-passenger touring-car—three years old, and making a none like a pack of lions caged in a saw-mill. This hird was sad. Wagged has bend. 'You know, I can't understand it at all,' he complained. 'A friend of mine bought a car just the time I did—the same kind of car, too,—and his is running good yet. And just look at mine"

"What kind of oil have you been

using?' I saked.

"'Well, you see, I've been saving on my oil bill,' he told me. 'Pound a place where I could get it cheaper—15 cents a quart most of the time—but I don't know exactly what kind of oil it was,'

"SO THAT poor oil was the finish of his car on the road, and that was why he brought his car in to me to be chopped up for hash. If you could see all the worn bearings and grazes and frozen pistons that I do, you'd soon understand how important it is to have your car well heeled with high-grade oil. The poor stuff hasn't any body. It simply turns thin, like water, when it gets hot.

"But bad oil isn't the only reason why cars give out, by a long shot." As if to emphasize his point, Frank went to a pile of junk and hauled out a set of gears and a crankshaft that he had taken from a high-powered car.

"Look at this," he said, pointing to a crack clear across the first and largest gwar. "The speeder who owned that car

just couldn't make his left foot behave on

the clutch. How do I know? Because I sold him two sets of gears beside this one. Every time he would go to start that high-powered car of his, instead of easing the clutch is slowly, he'd let 'er in with a jerk that would tear away at the workings. Something was bound to give sconer or later—the gear, the shaft, or the rear end. In this case the gear cracked straight across. He never could learn, or at least he never took the trouble to. Finally he got disgusted and sold me the whole out-fit. Said he wanted a new one."

A MACHINE that obviously had been through a frightful wreck tay close to the pile of parts, a ghastly mass of splinters and twisted metal.

"Now that," said Frank, "is the kind of a mess I get from a driver who won't take it easy. You've seen the kind I mean many a time. He drives by fits. One minute he's going 50 miles an hour, and the next minute he's jamming on the brakes. Never can seem to move easily

along at an even pace.

"Every time this fellow slammed on his brakes, he not only wore down his brakes, but he racked the driving mechanism from stem to stern, he wore out his tires, and he put a terrific strain on the whole car. And at last he got what was coming—as nearly all such drivers do sooner or later. One evening when he was going like mad, he hit a sharp turn in the road. He jammed his brakes, as usual, but the terrible side strain as he made the turn actually pushed one of his front tires clear off the rim. He lost control, landed in a ditch. And this here is all that was left."

In Frank's place there was plenty of evidence of other kinds of carelessness and recklessness. One machine a pitiful ghost of many a joyous motor party—drooped and sagged, for all the world like a broken-down, overworked rag.

FRANK stood studying the wreck for a moment, then conjured up a vision of the machine when it was sleek and new

It had been a light five-passenger sport model of a popular make, he recalled. The owner, when he bought it, had been wildly enthusiastic. "Come on, follo," ha had said to his neighbors, "let's all take a ride." And they all piled in--10 of them. Some crowded into the cents, others rode the runningboards, and others sat on the fenders The springs Everything sugged nagged The sleek new car groaned under twice the weight it was supposed to carry The motor strained to pull the load. And that was the beginning of the end of the machine's short life of usefulness.

"This business of overloading," rumi-(Continued on Jage 141)



How Auto "Hash" Is Asserted According to Make

The parts of "chopped tip" care are norted into bestile compartments, each bearing the name of a particular make. Frunk has in stock the parts for 400 different makes of care—mything "from a crank handle to a tail-light." and innumerable note and holts

There's Magic in Numbers

Simple Tricks with Figures that Will Mystify Your Friends—How to Read Your Fortune with Numerals

F YOU have no head for figures, don't warry about it—you're in good company. Any number of clever, even brilliant people are termfied by arithmetic, while the very thought of the higher mathematics makes their heads reel. There is a cort of inhuman morality about numbers. They cannot lie. They are incorruptible.

However, even the uncompromising numbers have their moments of relaxation. While they cannot lie, there are times when they seemingly do so; and they amass and deceive the most scholarly And also they have powers and qualities quite distinct from their purely scientific

and ordinary uses.

Among these we may include the powerful influences exerted by certain numbers all through recorded history, in mythology, and even in our life today Take the singler 13. Who will deny its power? Again, there is the mystic 7, symbol of luck since numbers were invented it has been dramatized and exalted above all numbers

The 8 was featured highly in pagan systems of religion. It is the number of finality expressing the superlative degree of effort or excellence. We have it in the auctioneer's "third and last call"; children use it in their games; the hero always wins out on the third attempt.

NINE is the highest-powered digit, hence it always has been associated with quantity, magnitude, and ideas of grandeur. It is susceptible of more juggling than any other numeral. One of its many peculiarities is that the digits of any of its multiples, when added together, always total 9. Thus, 3 times 9 equals 27. The digits in this, 2 plus 7, equals 2. Try any other combination and you will get the same result.

Among the most interesting number stunts with which it is comparatively easy to mystify your friends are "boomerang" tricks, so called because of the process of sending a number forward by addition and multiplication, and bringing it back by subtraction and division.

In an amusing game of this nature one may determine a person's age. The trick proves very puzzling, yet it is really simple to perform. Supposing the subject's age is 15, this is the way you will determine it:

Tell the subject first to multiply by 2 the number of By Karen Adams

the month in which he was born. Say he was born in August, or the eighth month, then

2 times \$	equals	16
Add 5	84	21
Mulciply by 50	-00	1050
Add age (\$5)	44	1065
Subtract 345	41	700
Add 115	44	815

The subject does all this figuring as you direct and gives you the final total, 816. You then are able to tell him he was born in August (first number, 5)

and is 15 years old (last two numbers).

A more elaborate stunt is to determine a figure erased from a series. Ask someone to think of four or five figures, or even more. Say he takes 45956. Tell him to add the separate digits; 4 plus 5 plus 9 plus 3 plus 3 squals 29. Have him subtract the result (29) from the original figures, which leaves 45909. Then have him strike out one figure from the 45909. Ciphers cannot be stricken. Say he strikes out the 4. Then have him total the figures that are left.

Five plus 9 plus 9 squals 23. This total he gives to you. You then think of the nearest multiple of 9 higher than the total.

which in this case would be 27, 3 times 9). You then subtract the total, 23, from 27, leaving 4, which, you tell him is the number be struck out. If the total he gives you is an equal multiple of 9 such as 18, 27, or 36, then the number he struck out is a 9

A similar trick appears very mystifying. Ask a person to think of two numbers, from I to 6. You then offer to tall what the numbers are. This is the way to do it

Suppose the numbers the person had in mind were 4 and 6. Ask him to double the first number

Add 5 " 13 Multiply by 5 4 65 Add second number (6) 4 71

You then ask to be told the total. From the total (?! in this case) you subtract 25, leaving 46. The number at the left in the final figure is the first number your subject chose, and the number on the right is the second. This trick can be done with two dice, guessing the numbers on the upturned faces without seeing them.

Here is another trick that proves very baffling. Have aome one set down a number containing five figures. With this before you, you write down a number on another sheet of paper, which you fold and ask the subject to keep without looking at it. This concealed number will be the answer. Under the first row of figures the subject sets down another row of five. Under that you put a row The subject then adds another row and you do likewise, making five rows altogether Ask the subject to add the

Continued on page 157;

\mathbf{A}	Mystify	ing	Table	that
	Tells	You	r Age	

3 5 7 9 11 13 15 17 19 19 21 22 22 27 29 31 33 33 37 39 41 43 45 47 49 55 55 55 56 56 56 56 56 56 56 56 56 56	3 6 7 10 11 14 15 18 19 22 26 27 30 31 46 47 50 154 55 58 59 63 63	7 12 13 14 15 20 21 22 23 29 30 31 36 37 38 39 44 45 46 47 52 53 54 56 61 62 63	9 10 11 12 13 14 15 24 25 26 27 28 29 30 31 40 41 42 43 44 45 46 47 56 57 58 59 60 61 62 63	16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 48 49 50 51 52 53 54 55 56 61 62 63	33 33 33 33 33 33 33 33 33 33 33 33 33	
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To learn a person's age, ask him to tell you in which column or columns of this table his age appears. Then add the figures at the top of the columns he names.

If, for example, his age is 36, he will tell you that his age appears in the third and each columns. The top figures of these columns are 4 and 32, which, added, give the correct answer.

Is Sleep Just a Useless Habit?

Scientists Seek to Reclaim the Hours Now Lost in Slumber

HOSE eight hours out of every 24 that you, like most of the rest of us, spend in the mysterious stuper that we call aleep—what is their purpose? Practically a third of your life you spend in the brank unconsciousness of alumber is this really necessary, as physicians long have believed, to rest your tired body and mind and restore your nervous energy? Or is it simply a useless and tragic waste of a third of the precious hours of a lifetime?

A few weeks ago eight students of George Washington University-four men and four women—under the supervision of Prof Fred A. Moss, hend of the university's Department of Psychology, yountarily submitted themselves to a test of 60 continuous hours of wakefulness. One purpose of the experiment was to answer this very question-of whether sieep actually is vitally necessary. And while the answer was in no way conclusive, it seemed to tend to corroborate the conclusion reached by other scientists in recent months.

That sleep, instead of being a "blemed thing," really may be a wasteful habit handed down to us by our primitive ancestors.

While Professor Moss declares his experiments are just beginning, his findings in the first test with the eight university students reveal these surprising discoveries

Sleep really is a kind of intextention Like drunkenness, it has to was t

tion, actually may be harmful, deadening the activities of mind and body.

Some persons can sleep feater than others, By training yourself to steep rapidly, you should be able to sump the aquivalent of your present eight hours in sux hours, thus adding two hours, or 25 per cent, to your normaallotment of eight hours for productive work.

IN THE last three years ProfessorMosa has reduced his own period of alcop to aix hours without impairing his efficiency.

While prolonged wakefulness causes extreme drowsiness and irritability, apparently st does not result in any harmiul effects on the body. At the end of their long vigil, the eight students declared they felt "in fine shape." Indeed, two of them, Watson Monroe, 17 years old, and

By Newton Burke

Lester Petric, 35, were not satisfied when they reached the 50-hour goal, but extended their alceplemness to 80 hours. And even then they expressed their willingness, when they were ordered to bed, to keep awake indefinitely.

Further, in tests of the students' ability to drive cars, Professor Moss found that while a person's capacity for operating an automobile is lessened after 60 hours without sleep, there is a noticeable lmprovement after 55 hours.

Similar indications that sleep may be nothing more than a habit that can be thrown off, at least to some extent, were developed during experiments several mosthe ago by Dr. Nathaniel Kieltman and Dr. N. F. Fisher at the University of Chicago, and described in the July insue of POPULAR SCIENCE MONTHLY. Remaining awake for five days and four nights-115 hours, to be exact—they found they could shake of the invasion of slumber by keeping their muscles contracted.

Among notable scientists who have been studying the mystery of alcep, there is one-Dr. H. L. Hollingworth, professor of psychology at Columbia University-who has gone so far as to advance the astonishing theory that it may be possible to develop a alceptess He declares that eventually we may eliminate sleep entirely by scaling

it down gradually and getting accustomed to going without it. A way to do this, he suggested, is to reduce our sleep five minutes every two months. At the end of 16 years, provided we start at eight hours a night, "the stuper of sleep would be banushed—if it could be."

DOCTOR HOLLINGWORTH calls sleep a "tragedy to which we should give the same consideration that we do to other human ills." His theory is that our deep-rooted desire for alumber in inherited from our remote ancestors who, when night fell, were beammed in by a wall of blackness. Without lanterns and without electric lights it was impossible for them to carry on the activities of the day. They had nothing to do, and naturally when night came they fell into a sort of blank stuper which continued until daylight returned

That, says Professor Hollingworth, is why so many of us begin to feel drowny when night comes, and why you not and go to sleep before your fireplace at the and of the day,

Other scientists, notably Dr. Frazer Harris, Dr. A. W. Crile, and Prof. Arthur Cotton, are endeavoring to find a substitute for sleep. Believing that the need of slumber is caused by electrochemical reaction in the brain cells, which drains them of their vitality, Professor Cotton has been working on an electric apparatus that he believes will recharge the worn-out cells by direct electric current instead of by sleep.

> Whatever may be the final solution to the every-day mystery of sleep, the fact remains that some men can do without aleep to a very large extent and still achieve great things. Thomas Edison, for one, has given striking demonstration of his pet theory that sleep is largely unnecessary. Such men as Napoleon, Frederick the Great, Schiller, and Tesla have been satisfied with from three to five hours' sleep daily. If they can do it, why not everybody?

AN AVERAGE mon of 45 years today has spent about 15 years of his life in number. Despite the latest experiments. however, it is the concensus of scientific opinion that thus far there has been developed no way for the average man to reduce his sleep materially without a bad effect on his health.



They Stayed Awake for 60 Hours

Professor Fred A. Moss (center) head of the Psychology Department of George Washington University with the eight students who stayed awake for 60 hours and more under his supervision. Front row left to right Letter Petrie Thelma Hont Professor Most. Katherine Ostwakt and Robert Ward. Back tow left to right. Dr. W. Middleton Alice Hames. Looise Conwakt, and Watson Mourne. Two of them kept awake for 40 hours.

What Airways Promise Us

Vast Network of Freight and Passenger, Mail and Express Lines to Cover Entire Nation

By Robert E. Martin

FEW weeks ago a grand plane was transported by airplane from New York to Washington! Twenty years ago you would have been laughed out of court if you had suggested such a thing; but today it actually has been accomplished. Today it is possible to transport not only grand piance, but almost any article you could name, from a sewing-machine to a kitchen stove, all the way across the continent through the air from New York to San Francisco. In fact, only recently a wealthy aportamen even negotiated to have a race horse carried from one city to another across the skyl

Such marvels of transportation, undreamed of only a few years ago, simply testify to the fact that America, undaunted by tragic mishaps like the loss of the Sassandock, is forging shoud in serial navigation to an extent that is amazing the world. Mail routes, pamenger routes, freight routes now existing form a nation-wide network of already that promises before long to cover the United States more thoroughly and speedly than any other means of transportation.

The necessity of rushing a piano through the sky is not apparent, but there are other types of freight where speed of transportation means a tremendous economy. In carrying perishable vegetables and fruit, for instance, the need for hundreds of tons of ice to keep them in perfect condition does not exist on the air routes. In the first place, the fruit is transparted so quickly that it has no time to decay and, in the second place, the pilot of the freight airplane always can seek a higher level where the air is extremely cold, even in summertime.

AS FAR as passengers are concerned, the simplane now has taken a well-defined place in our scheme of transportation. Regular air routes for passengers are now in use in many parts. of the country and more routes are being planned. And, in addition to the regular routes, it is possible to charter a special plane for a rush trip to almost any point in the United States.

The Army Air Service is operating a model sirway that connects New York, Washington, Norfolk, and Dayton, es well as Detroit and several points in Musicuri, Illinois, Oklahoma, and Texas. More than 500 flights have been made. Pilots of this branch of the air service alone carried 349 passengers and 46,707 pounds of non-commercial matter over a distance of 951,130 miles without the loss of a single life!

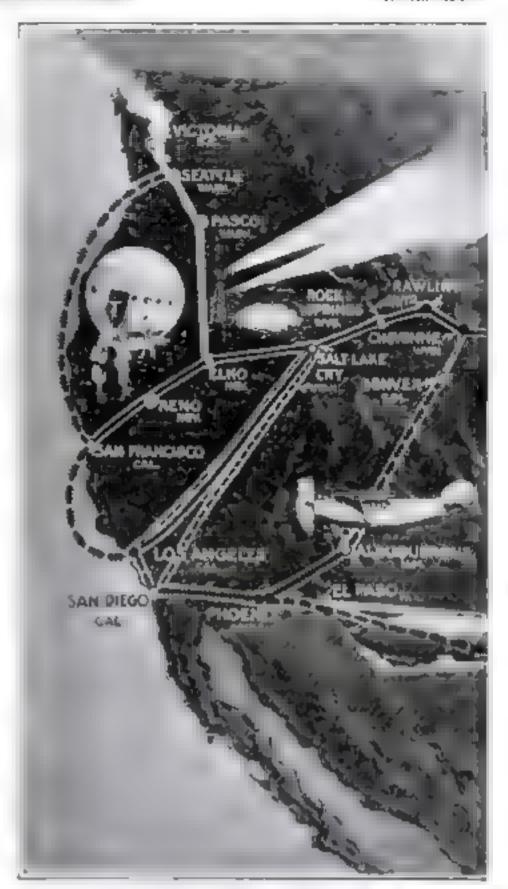
Commercial passenger lines are already in existence and regularly organized companies are contemplating a transatlantic passenger pervice that will include the more valuable

classes of express matter.

Chambers of Commerce and Boards of Trade throughout the United States are racing with each other in the establishment of suitable landing-fields so that their cities will be included in the proposed routes, for good landing-fields are a prime necessity in airplane service.

IN EUROPE where, for military reasons, each of the more important countries is interested in the development of flying as a matter of national defense, the air routes are subsidized heavily by the governments. This country conclusively demonstrated its disapproval of subsidies when it voted down President Harding's ship subsidy plan, but in spite of the lack of support, development in aviation is taking enormous strides forward.

While refusing to subsidize commercial companies engaged

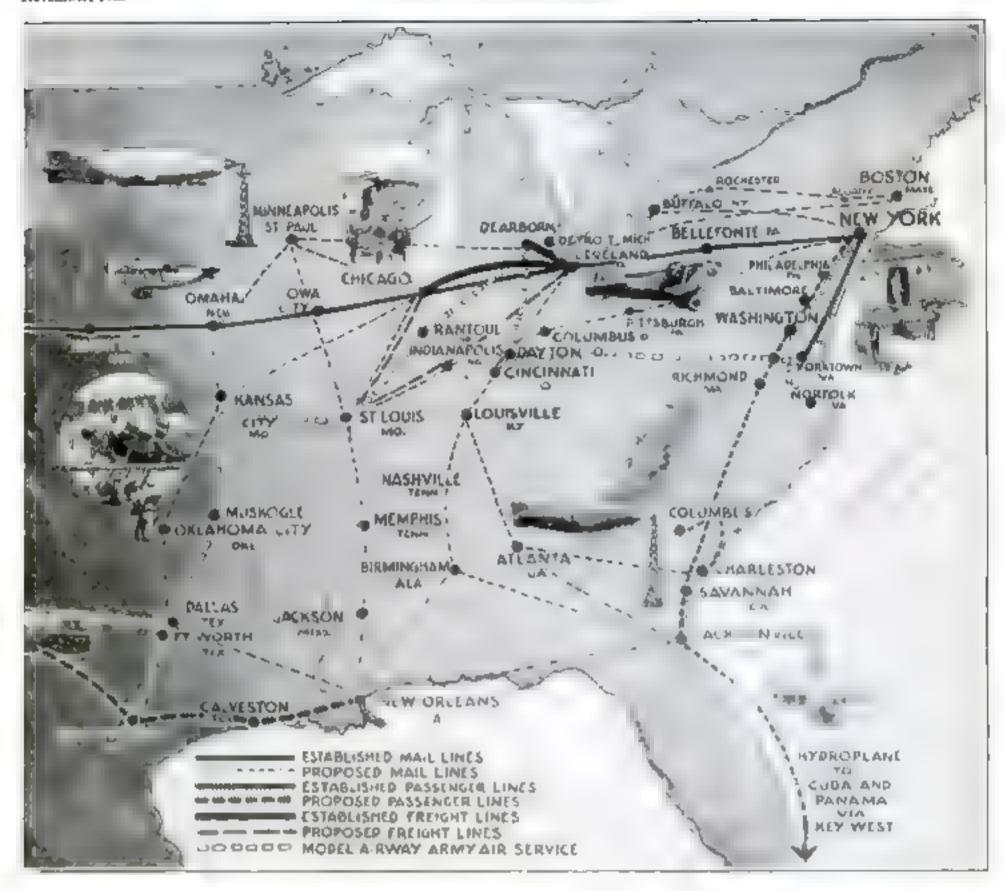


How America Develops Aviation

in aerial transportation, the United States Government has gone far to advance aviation by the establishment of the Air Mail Service, which transports mail from New York to San Francisco in 33 hours as compared with the fastest railroad mail service, which takes five days to travel from the Atlantic to the Pacific.

OTHER sections of the country have been looking with envious eyes at the superior mail service enjoyed by the cities located on the present Transcontinental Air Mail Routs. Los Angeles believes that the western end of the route should be in Los Angeles rather than in San Francisco, while Boston claims, logically enough, that the eastern terminus should be in Boston, with New York as an intermediate point. In the view of Post Office officials, this claim is not so very far from communication except that Boston would be made the northern terminus of a coastal route, connecting with the westbound line at New York. Under this plan, planes would stop at all of the principal cities along the Atlantic Coast clear down to Florida.

As a matter of fact, air-mail service for all parts of the United States seems to be a certainty in the very near future. Under a law passed early this year, the Post Office Department recently called for and received bids from private concerns to carry the mails on eight important new routes: Los Angeles-Seattle, Salt Lake-Los Angeles, Elko (Nev.)-Pasco (Wash.), New York-Boston, Chicago-Fort Worth-Dallas, Chicago-St. Paul-Minneapoles, Chicago-St. Louis and Chicago-Birmingham,



into Great Transportation System

This up-to-the-ministratorial map of the United States above the paperager freight and mail mass, established and proposed, that eventually will link all of our important cities to a vast network of six transportation. Every big city already has made provisions for suitable landing-fields, beacons, and signaling apparatus. In the past four years more than 500 000 passengers have been transported over 12 000 000 miss. Approximately 600 000 passed of freight have been current. These figures are based on statistics of established air kines and do not lockage bundreds of itinerant lights, the odd-job men of eviation.

This new air service will directly connect 29 important cities with the 16 cities which already have been receiving the transcontinental air-mail service. The eight new routes will mean an extension of the air-mail service for 4662 miles, while the fulfilment of the contracts will require about 390,000 miles of flying yearly on the six round trips per week scheduled for each route.

SINCE the new law provides that private concerns carrying the mails may also transport freight and express matter, it is expected to go a long way in the development of commercial aviation. In view of these advances Col. Paul Henderson of the Post Office Department recently predicted that in 10 years mail planes will be flying not only all over the North American continent, but to Central and South America, to Europe, and to Asia by way of Europe.

The ultimate expansion of the transportation by air of passengers, mail, and freight will be governed, of course, by strictly economic considerations.

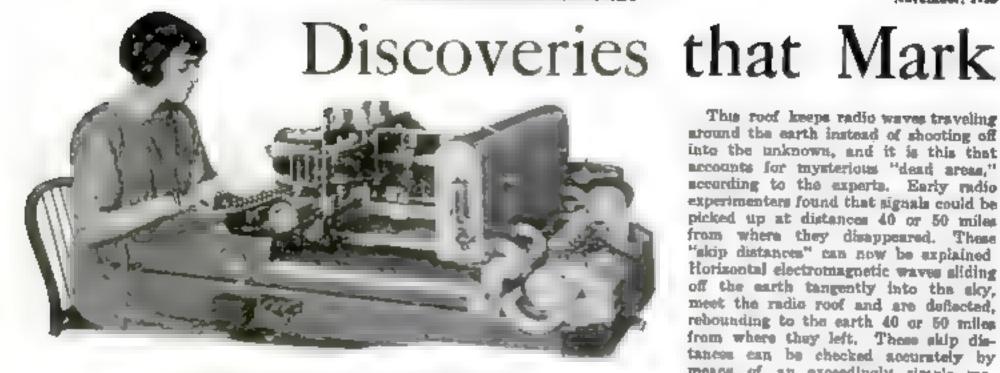
How much will it cost? How soon will it get there? Can I afford to wart? Questions such as these will be the determining

factors, just as they always have been in the past. Naturally, they will not be equally important in all cases. With one man, the quick delivery of his goods is the paramount consideration. Another will find that competition has forced his profit down to the point where it is vitally necessary to save every penny, even at the cost of slow delivery.

Undoubtedly, the cheapest known form of transportation is by boats across bodies of water. No railroad can compete with a steamship on a rock-bottom cost or a ton-mile busis.

The reason for this is that the water maintains itself in condition for use as a track for the ship to travel over at no cost to the ship-owner, whereas the largest part of a railroad's maintenance cost goes to keep the tracks and the right of way in good condition. In this respect, the sirplane is on a par with the boat, because flying through the air certainly does not wear the sir out. On the other hand, the amount of engine power required to keep an airplane in the air is transendous. A big sirplane able to earry only a few tons of freight needs an engine so powerful that it could drive a small tramp steamer capable of carrying hundreds of tons of freight. And the same comparison holds good with the railroad locomotive also

IN SPITE of the cost handicap, however, air transportation is bound to win a big place in the general scheme because it has the one great advantage of extreme speed, and speed every day is becoming more and more the first consideration, both with passenger and freight. The business man who arrives first has best chance at landing an order, and freight that first reaches its destination has the best chance of being sold.



New Printing Machine Sets Photographic Type

By perfecting a machine that sets type by photography. J. R. C. August and L. K. Hunter. London inventors, claim to have discovered a revolutionary method of printing that eliminates the used of metal type. The binds of the invention is a unster film on which letters, figures. and all kinds of type have been photographed. By motors of a keyboard recentling a typewriter characters from the firm are projected and princed, one by one, on a constitued base

Cakes of "Dry Ice" by Mail

CIENCE has just perfected a marvelour new way to keep ice-cream frozen in its original state for hours at a time without the use of ice. It is now possible to send a pint of ice-cream from New York City to Chleage by air mail, and when the package is opened the ice-cream will be found frozen hard, just as it came from the freezer many hours before!

The wonderful material that makes this remarkable feat possible is called "dry ice." It cannot melt. It is perfectly dry to the touch, and yet it is no cold that it will make a thermometer go down to 110 dogrees below zero.

You have noticed the small bubbles that form and rise to the murface in a sods-pop bottle when you pry off the cap. This new ice is made put of the same gas that forms those bubbles. In other words, it is earbon-dioxide gas cooled down and compremed until it finally forms a solid, frozen mam.

Solidified carbon dioxide has been produced on a laboratory scale neveral times, but this is the first application of this queer freezing agent to the preservation of ice-cream. Its use is the result of a long nearch by a New York lce-cream manufacturer for a method of packing his product in small packages so that customers can take it home and keep it in perfect condition for hours afterward.

Although the temperature of dry ice is colder than the North Pole in wintertime, it may be handled with the bare hands, provided the skin of the fingers is not allowed to touch the solid lumps for more than a second or two at a time. In the ice-cream plant, lumps of dry ice are sent to the packing room, where a workman places a cylindrical piece in a large carton, which also holds a smaller container filled with ice-cream.

The outside container, as well as the one that holds the ice-cream, is made of paratitued cardboard and is, itself, a fuir heat insulator, so that the warmth from the outside air penetrates slowly. Instead of heating and melting the icecream, the air warms the surface of the block of frozen earbon dioxide and



Packing Ice-Gream with "Dry Ice"

The "dry lee"-mail cylindrical blocks of solidified carbon dionide—in placed in parefficied cardboard cartons that also hold the ice-cream in separate containers

gradually converts the latter back into a ritega ang

The gas then passes away through a small hole in the outer container, and when it is all evaporated no trace remains to show that there ever was anything in the larger container except the package of Ice-cream.

"Radio Roof" above Us

TENTURIES ago people learned and firmly believed that the starry sky

Scientists soon banished this Illusion, but now in the twentieth century radio experts of the U.S. Navy and the Carnegie Institution assure us that above us there is actually a remarkable "radio roof," an ionized ceiling that deflects waves bumping against it.

Its exact size, shape, and location must be determined through further experiments, but it is known to he more than 100 miles above the earth, where our atmosphere fades into ether. It rises and falls as atmospheric conditions vary.

This roof keeps radio waves traveling around the earth instead of shooting off into the unknown, and it is this that accounts for inysterious "dead areas," according to the experts. Early radio experimenters found that signals could be picked up at distances 40 or 50 miles from where they disappeared. These "skip distances" can now be explained Horizontal electromagnetic waves sliding off the earth tangently into the sky, meet the radio roof and are deflected, rebounding to the earth 40 or 50 miles from where they left. These skip distaness can be checked accurately by means of an exceedingly simple mechanical device.

The discoveries are expected to be of great value in wireless communication. especially in eliminating "fading." The eventual achievement, according to Secretary of the Navy Wilbur, will be the hullding of a high-frequency transmitting station, costing \$60,000, that will give better service and longer range than the present high-power stations costing \$2 000,**000**.

Radio waves such as we know might be able to travel in the ether outside the carth's atmosphere, but first we should ave to find a method of forcing them through the culling.

Once outside, we might achieve the dream of having them carry musages from us to other planets.

To Harness Tides of Fundy

E NOUGH power to light and heat the entire eastern part of the United States and run all of its factories, is promised by D. P. Cooper, a hydraulic angineer, who recently started a project to harness the tides of the



Tests Safety of Bridges

Marris Berman, young investor of Brunklyn. N Y is shown here with a new apparatus be has perfected to determine exactly the load that bridges can bear. He dectares it will give engineers absolute separance of unfety in their plans for future bridge construction. Progress in Science

Bay of Fundy, just off the coast of Maine. near Eastport

He proposes to dam two inlets with grant walks and gates, and control 150 square miles of ees. The tide rises as much as 27 feet. By regulating the outflow, it is figured that from 500,000 to 700,000 electric horsepower would be generated-twice the amount of energy that Muscle Shoals is expected to yield

Mr. Cooper's prominence gives the planto harness the tides of the Bay of Fundy. described completely in POPULAR SCIENCE MONTHLY for May, 1924, new significance. Mr. Cooper helped build the great hydroelectric power plant at Keckuk, la., on the Massissippi, and has built hydraulic power stations at Niagara Falls. The Governor of Maine has given his approval to the project, pending the result of a state referendum,

Organ Tones for the Piano

IN HIS cottage in Gloucester, Mann. before an audience compresed of some of the world's most famous musicians. John Rays Hammond, Jr., a well known inventor, recently gove an amazing recital. He demonstrated for the first time an Invention that practically turns the piano into a pipe organ. Professional musicians have declared it the most remarkable Improvement that has been made in the plant since it was evolved in the eighteenth century.

Ordinarily, when the keys of a piano are struck, no matter how hard, the tones fade away gradually. Mr. Hammend's invention permits the player to control the tones, either sustaining them, letting them grow, or die. Reflectors set Inside the instrument, controlled by a fourth pedal, made it possible to build up a tremendous sonority. These reflectors are parallel revolving slats that are opened or closed by the action of the pedal. They cause the sound to rebound to the sound-



ing-board. The volume of tone depends on the angle at which the reflectors are set by the pedal

In exterior appearance the plane is httle changed, except that the case in slightly deeper. The fourth pedal is used automatically just as the expression pedals are. A means for adapting the system to player-planes has been worked out also.

Radio Waves from the Brain?

CERTAIN group of believers in A CERTAIN group have been asserting for years that when we think, the brain sends out actual waves. These are carried through the air, they say, and may he received and understood by another person whose brain is attuned to the particular wave length transmitted

Professor Ferdinanda Cassamali, an Italian scientist of the University of Milan, has just finished come unique experiments which, he says, give this theory a scientific basis. When our brain radios are understood fully, be declares, we shall have a new method of sending messages far superior to wireless telegraphy

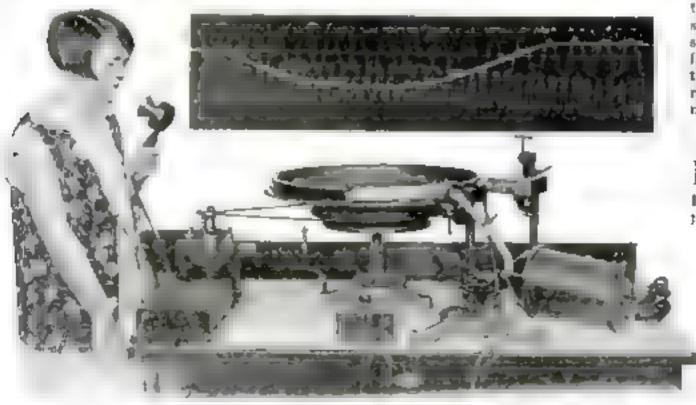
He experimented with highly excitable persons suffering from mental ailments. He put isolated men and women in an insulated cabinet, hypnotized them, atiminted their mental faculties, and listened to the reactions through a wireless headpiece attached to his ears. He declares

that be heard waves similar to radiotelegraphic transmission sounds, which stopped immediately upon waking the subject. The waves varied in length from four to 10 meters. Sometimes the sounds were accentuated until they resembled whatling or the tone of a muted violin.

Candy an Aid to Runners

HAVE a chocolate, college athlete. Experiments made recently by Dr. Burgess Gordon and other Boston physiciam contradict hard-hearted trainers who forbid candy.

Marathon runners were placed on high carbahydrate diets before the races, besides being supplied with candy and oversweetened test. Blood tests taken after the races showed far less exhaustion then was true of the same men in previous marathous. There was striking improvement in their general physical condition, the physicians declared, and the athletes made better running time than those who had not eaten chocolate.



Singers' Voices Photographed and Analysed

The voice of a singer or openier now can be photographed and analyzed by means of this remarkable. machine recently constructed at the University of Lows. The issuet shows a record of the souths graduced by the singer at the left. Veterations set up by the award waves actuate a delicate merror device that flashes a point of light on a rapidly moving film, giving a complete chart of the sound waves

Men Who Have Made

And Others Who Have Found Happiness



He Wields a Mean Brush

When he is not wicking the baton-Walter Damrosch, famous conductor of the New York Symphony Orches bro, deights in awaying the past brosh at his country home at Ber Herber, Me. His is just the common garden variety of pointing, but he can start a chair or cost a barn with the enthusiasm of a real artist



Explores the Sea

Lured by the mysteries of the deep sea, Dr. Hann Hartman (left), American engineer, is beaching an expedition into the Mediter ranean in search of buried cities. He has invented a diving cylinder in which he expects to explore sea depths of from 5000 to 15,000 feet

Plays with Glass

The hobby of reproducing famous stained glass win dows is an inherited passion with Jacques Simon, a French artist below). Now he is matching colored glass for wing was in the restoration of the war lamaged Rhestis cathedral in France



Just for a pastime, Herr Horaz, German actor, stands on Berlin streets and endeavors to prove he is the most long-winded talker in the world. He has talked 20 hours and soon will try for a non-stop record of 48 hours, he has just amounced

Picking bloeberries is recreation for Richard W Sullivan (right), of Washington County, Mc. He holds a record of 20 bushels a day, gathering the fruit with the aid of this ingenious rake.



and Profit in Unusual Pastimes



No More Scorching

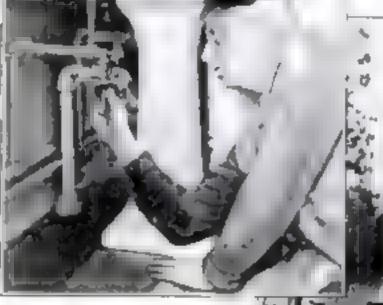
Marin C. Bersted, of San Diego, Can' grew tired of seeing soutches in all their front, so in his space time he invente a fire proof electromes that turns of patomatically when a certain temperature as reaches. Then turns on again as the fron coda

His Own Plumber

Frank Hedley, hend of New York's subway system, prefers I nkering at orid plus about his home at Green's Farm, Coras to playing golf for recreation. The picture at the right shows him repairing the plumbing

Plays with Toy Trains

For more than 20 years J N Swortest proposent business man of W sampt of D. C., has beyond all his cold moments to the organism of a manature railway system. Each me I his model to make we and core is unit to be mechan ally perfect

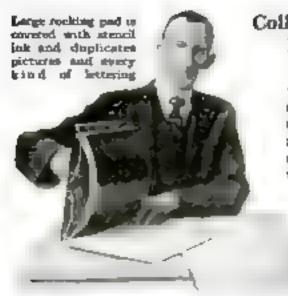


A Wayside Pottery Maker

Jacob Dyorson a native of Jug. Slavia, discovered a bell of clay in his little farm near Speking, Wash. He built a k in and now when the chores on the form are done, he sells old pieces of pottery at the roadside. The picture shows the variety of patterns he achieves

Young Pershing an Auto Mechanic

When not attending school near Lausanne France. Warren Pershing left 19 year-old son of General John J. Pershing, spends his vacation as a mechanic in a Paris automobile assembly plant where he will learn all about motor-cars.



Reproduced by New Device

has the shape of an arch with larger

radius than that of the common

type of cylinder duplicators. The

ink pad has a base of very fine wool.

govered with a closely woven fabric

and is claimed to do the work with-

out smearing. Stencil ink is applied in the ordinary manner and ordi-

nary stencil papers are used. The

machine is made in three sizes.

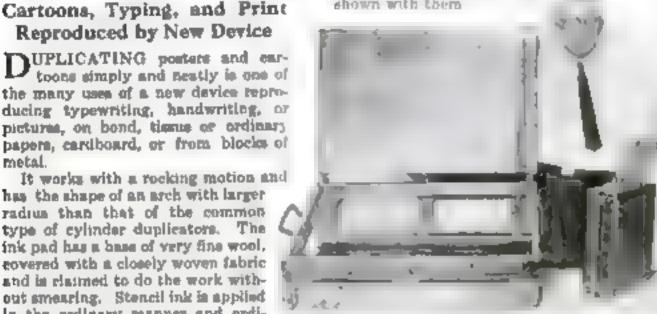
Collapsible Egg Crate and Packing-Box Proves an Economical Invention

COLLAPSIBLE packing-box and agg crate A that may be sent back to the shipper when empty, while costing more at first than the ordinary ones, is declared to be economical and an and in the conservation of lumber. The larger container in the photograph is 17 inches deep and will collapse to a depth of 6 4 inches, while the

small one, 12 inches deep, will collapse to a depth of four inches.

The two containers pictured below have seen five years of hard service on the railroads, and are said to be still good.

Adolph Van Schluembach, of Washington, D. C., who invented the unique cases 😘 shown with them



Crure and box folded take three types less their open size

Know Your Car

9] \$4] || 544 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545 | 545

THE wheel bearings of an autorequire very little attention. For this reason motorists are inclined to take the condition of the whose bearings for granted. But complete neglect usually means a repair bill and sometimes a bad secident.

Properly cared for, the wheel bearings will outlast the other moving parts of the car. You can keep them in good condition by following these rules:

 Thoroughly clean all wheel bearings at least once every 5000 miles. Be sure to remove all of the old greams. Gasoline or kerosens should be used for cleaning.

Examine the surface of each ball with minute care and discard any that show even the faintest sign of a crack

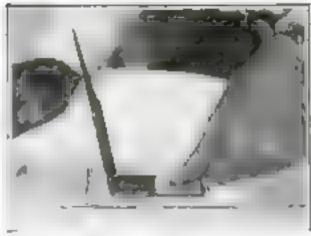
3. Replace broken rollers or balls with new ones only after you have made certain, by the use of a micrometer, that the new parts are precisely the same diameter as the other balls or rollers in the bearing.

4. Reassemble the bearing and pack it carefully with a high grade of soft cup grease.

5. Adjust the ball bearing so that it will turn freely without perceptible play. Set the roller bearing so that there is just perceptible pury.

Doctor Says Anesthetized Patients Do Not Talk

PERHAPS you are one of those who dread taking an anouthotic in the dentist's office or operating-roofs because you might may things in your sleep Doctor Floyd Troutman, an anesthetist, says that this four is groundless. Under modern methods of administering anesthetics, he explains, consciousness is lost so rapidly that the patient dom not have time to say anything. And on coming to, he usually is so drowsy that he husn't the energy to talk.



Fingerprint Pad Is Carried in Depositor's Check-Book

TINGERPRINTS, surest method of adentification yet discovered, now may be used an checks for protection against fraud. A compact outfit for this purpose slips into your hip pocket

made.

of purse One pad holds the ink, while another contains a cleaning cream for removing the ink from the finger or thumb after the mark is

The owner may place his fingerprint anywhere on the check. When the check-book is closed, a cover fits flat down over the pads. The fingerprints of depositors are kept on file in banks where this system is used, just as lists of signatures are kept in other banks,

U.S. Government Breeds Bugs to Test Insect Powder

IN A strange nursery on the banks of the Potomac, the U.S. Government keeps a bost of fleas, mosquitoes, mites, and flies. When fully grown, they serve to test poleons that are sold throughout the country for extermination of insects.

Among the most valued spristants on the bug farm are four dogs, two cats, and 125 chickens, who produce humper grops of fleas and mites. To get first-hand information on whether advertised mosquite and chigger proparations do all that they should, a human worker in the laboratory daube the stuff on one arm and spends the afternoon fishing on a chigger-monguito inferted bank.

Safe-Moving Device Saves Dangerous Labor

EXPERIENCE had taught John A Wagner, of Baltimore, Md., how hard it was to load and unload safes in trucks.

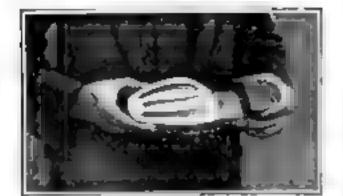
He lessened the danger of this moving job by inventing a device that puts rollers. block, and tackle to work instead of muscle.

The safe is alid on a platform that is even with the top of the street curb Its rear wheels rest on a heavy steel ledge, the bottom part a an upright carrying frame which the safe is strapped securely The frame the ... tilted back and slides over a

long roller that is set in at the end of the truck. With the help of ropes drawn through a winch or block and full behind the driver's seat, it is pulled up until it reats on its back in the truck, ready for the trip. Unloading the safe at its destination m accomplished by the



Placed on platform, safe is rolled on truck



Scotland Sends Us Shoes with Aluminum Gripper Soles

THICK Scotch must was responsible for the invention of gripper aluminum soles for golf shoes. The links in Scotland get very wet on musty days and a Scottish sportsman bit upon the metal sole idea to keep his feet dry.

The soles are fastened to the shoes by 10 tiny nails or screws, and afford the feet a firm grip on the ground. In the largest sizes the soles weigh less than two ounces and they are claimed to be strong enough to last a sesson.

Hunters tramping over damp ground, or those engaged in work that takes them out in all weathers might find the soles equally useful

Dead Sea Products to Enrich Palestine

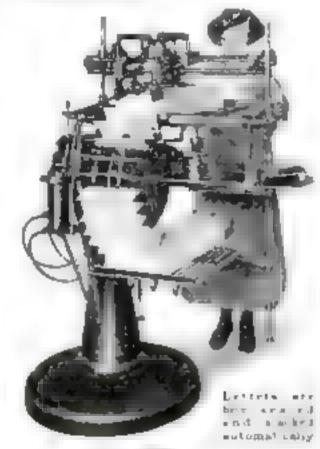
RICHES in the Dead Sea soon may make of Palestine a land of plenty. Rights of exploitation of the wast quantities of chemicals in it recently were offered for sale.

The supply of potsab in the waters is considered inexhaustible. Common sait would be obtained in such tremendous quantities that the problem would be how to get rid of it. It might have to be dumped back into the sea after more valuable saits had been extracted from it. The saits will be extracted by a system of evaporation and crystallization that is very rapid, on account of the stifling heat in the Jordan valley.

Transportation from the Dead Sea to the Mediterranean is the greatest difficulty foreseen

Automatic Sealing Machine Does Away with Hand Labor

A WHOLE row of girls, all working at top append, could not beat this novel sealing machine. It is designed particularly for the on advertising folders and other pieces of advertising matter that are sealed by means of a gummed sticker. The folders are stacked up by hand on the upper table, and the machine, after sealing them, stacks them in next piles on the lower table.



Slow Up Action

BECAUSE he believes that living at high altitudes is dangerous, a French scientist took a healthy young squirrel in a cage to the top of Mont Blanc for experimental purposes recently. The cage had a revolving wheel in it that registered every turn and that the squirrel was able to turn 6500 times every 24 hours at a low level, but only 900 times in the same period of time at the top of the mountain

Children's Boat Is Inflated like a Tire

THE children want a boat ride or father wants to go duck shooting and out comes a small fabric roll packed away in the automobile or carried on the back the same way that a knapsack is carried

The roll is blown up by an air pump, exactly as is an automobile tire, and in a few minutes is ready for its passengers. The long parrows air pockets along



Toy boat is balanced by air packets at each side

on an even keel, and make it reasonably safe for children to ride in in shallow water, where there is no strong current.

> A TREMULOUS earth means a young one, explained Prof. Charles W. Brown, a geologist of Brown University, Providence, in a lecture recently at Montreal. The aeries of earthquakes on the Atlantic and Pacific seaboards this year are mere evidence of growing pains, accordthe to Professor Brown. When the earth finally gets adjusted and settled in old age, there will be no more quivers.



Novel Invention Makes Every Cop His Own Signal Tower

RECENTLY Clarence A. Rich invented an ingenious strap and electric-light apparatus, to be fastened around the hands of traffic policemen so that their signals to motorists and such can be seen at night.

The red, green, and yellow lights of the usual traffic towers are reproduced in miniature for the policeman's hand signals, which are on the palms and the backs, not too bulky to be cumbersome.

Above is shown Traffic Officer Prendergast, of Swampacott, Mass., using the new signaling device. It was at Swampacott that the President and Mrs. Coolidge spent the summer, and where, consequently, due to many visitors, traffic was particularly beavy.

How Much Do YOU Know about Science?

THESE questions are chosen from the many that come to POPULAR SCIENCE MONTHLY every day. Look them over and see how many you can answer. Although the questions concern things that we all frequently encounter, it is surprising how many new and interesting facts they reveal about the world in which we live.

After you have finished, turn to page 150 and see how many of the 12 questions you were able to anawer correctly.

- 1. Why does gas form in cider when it ferments?
- Which was the first animal to be domesticated?
- 3. What are kilocycles?
- 4. Are men growing tallet or shorter?
- Do we need to be afraid of failing stars?
- Can we make water boil without heating it?
- 7. Why is it that when you are hit in the eye, it becomes black?
- How do artificial rubles differ from genuine ones?
 Why are the walls of a building usually blown outward
- by a ternado?

 10. Have scientists succeeded in
- changing the sex of an animat?
 11. Is electricity produced by our
- own bodies?

 12. How is the brain fed?

How They Figured the Thing Out

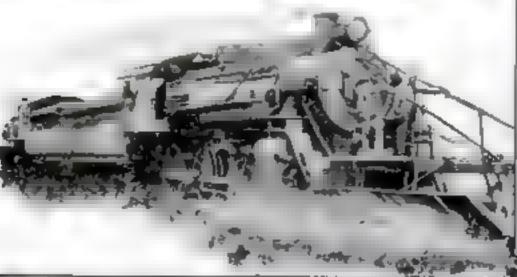


Ingenious Plan to Prevent Traffic Jams

To solve the problem of traffic congestion at a businessee in Berlin. Germany, City Architect Mulberg devised the node of each vated radiating wakes for pedestrians, shown in the costel above. At the center of the elevated platform in the entrance to a subway

Locomotive Steam Used to Kill Weeds

The Attenta Birmingham Railway was bothered with weeks of og the tracks with an engineer thing the found, beautiful to be and extend the Pipes can use the bound to a seed springer in front

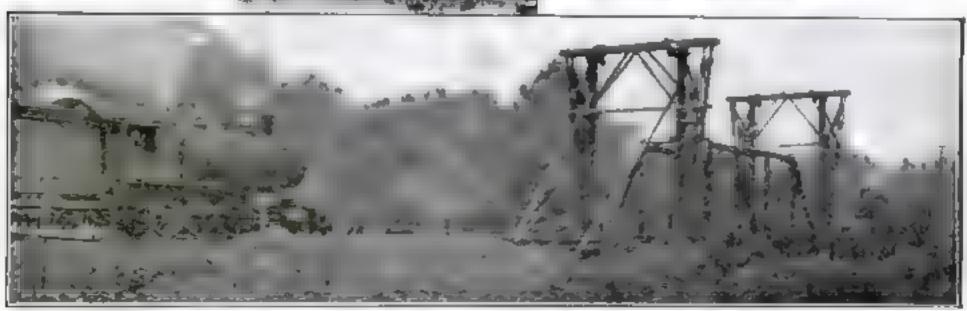


Soda Tank a Fire Bell

Getrettson Beach, near Sheepshead Bay, N Y, had a votust terr fire department but no fire bell, until a few weeks ago, when a firement thought of using an hose a water tank from the aragature

Saves Hard Labor

A Frenchman who had to move heavy furniture from upper floors, recently devised the apparatual at left. An adjustable metal pole fits tightly between the top and bottom of the window frame, and holds a swingery arm to which the furniture attaches by a pulley



Lifting a steel bridge twenty-three and one-half feet—enough to allow a ditching dredge to pass beneath—was a recent accomplishment of engineers near Sullivan, Ind., with the sid of two locomotives. Timber towers were erected at each end of the bridge to support block and tackle with which two locomotives, pulling from both sides, raised the 100-ton bridge bodily while the dredge passed through 1

Experts Who Work at Queer Jobs

Carves Birds in Ice

From rough blocks of ce Nino Angra relebinted see see piter of the Hotel Victoria Lardon carves may velous amonals brus, and lishes, the used as enterpreses. He a shown completing an be model if a pwan, which task about one hour

Makes Lures for Anglers

Twenty years of her life Mes Elizabeth Hecht (right) has spent making fishing tackle, tying their and seeing up a re-She is superinter lent of ay making in a large best for tory at South Bend, Ind-

A Tamer of Grocodiles

Captain H Was farmer German sea carthain 1 a a the termetion of bring the ary map in the age of the carthain his trained pets in the careas the year around

Champion Helmet Maker

Jihn Plovak below a native of Greece, in considered one of the world's greatest diving below makers. Yet he never has worn one of his creations. His shop is on the banks of the Anclote River, Florida

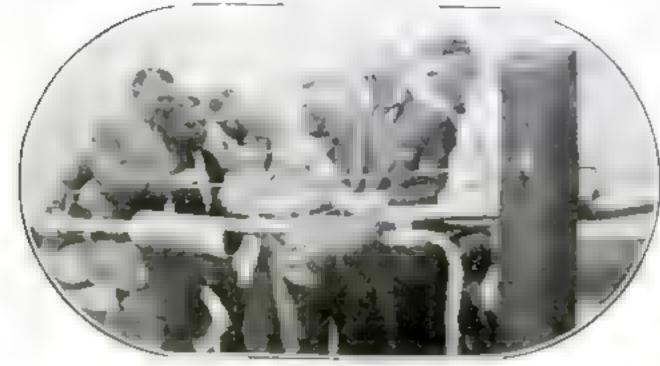
Washing Big Ben's Face

Keeping clean the face of Big Ben, the famous Houses of Parisament clock in London, is James Gordon's job. Here he is shown with an assistant hard at work 300 feet above a London street

How Would You Like This?

P D Buckley sits atop the New York Edwar Company power plant every day and watches the color of smoke and gases that risue from the guant smoke stacks. These observations are made to determine the highest attainable efficiency in coal combustion. Buck ley's job probably is the only one of sta kind in the world—and he likes it

Is a New Ice Age Approaching?



World's Longest Telephone Cable Completed

F. A. Streemann of the American Telephone and Telegraph Company is seen here making the last spice in the world a longest telephone have an 461-mile cubic connecting New York and Chicago, and furnishing express telephone service practically free from hazards of storm damage. The event took place recently at Swanton Ohio. The mammoth cubic will be able to carry 250 telephone conversations and 200 telegraph messages amultimatously.

So swift is the wonderful progress of science that the busy man often finds it difficult to keep informed of the new developments or to greep their significance. That you may keep pace with the march of science, the news of some of the outstanding achievements of the month is presented here in concise form.

SOME 20,000 years ago, toward the close of the great Ice Age. Europe was a country of blank, treeless plains, much like filberia or northern Canada of today. Wandering, primitive men lived on herds of reindeer and wild ponies that roamed the plains. Towns, villages, and forms were unknown.

Will hatory repent itself, with another Ice Age like the last one? Will the present European civilization vanish?

The startling prediction that Europe is drifting nearer and nearer a new Ice Age was made recently before the South African Association for the Advancement of Science by General Jan Smuts, former Boer commander, British general during the World War, and later Prime Manuter of the Union of South Africa. He placed the advent of the new age at 10,000 years from now, although, he predicted, long before that time European life will have altered beyond recognition by people living in our day.

The climate of Africa, he added, also will become gradually cooler, moist, and rainy, with the result that the present stretches of wilderness will pass away. In all probability, he said, our present human races will have disappeared before this next phase, giving place to higher species.

Predicts Aerial Cities

AN AMAZING picture of future cities built far above the earth on platforms reached by tower elevators is presented by Frederick Kiraler, a promi-

hent young Vienness architect. In these days of sixplenes, it is absurd, he thinks, that we still should be crawling around on the ground and burrowing into it to make dwelling places.

Distance is nothing. We can live anywhere we like, so why not in the freshest air obtainable? He predicts that houses in the future will be built on platforms supported by steel girdens several bundred feet above ground. They will be erected above beautiful gardens, shady forests, or even above lakes or the sea. Platforms will be provided, too, for landing places for simplanes, he believes.

A New Star Discovered

AS HE walked home in the early mornlage, a telegraph operator in South Africa had a habit of studying the starry sky. One morning he was startled by seeing a strange star in the constellation Pictor.



bunds Matter "Empty as the Sky

Matter is only a vacuum. "as empty in the sky" in which there are munified electric charges, according to Dr W R. Whitney Director of the General Electric Company Remarch Laboratory He is seen here using the latest apparatus for studying urenium atoms.

Amazing Prophecies, Great Achievements, and New Discoveries Set Pace in Science

him immediately that it must be a new one. He verified his discovery after breakfast, then telegraphed to the observatory at the Cape of Good Hope, which announced it to the world, one of the most noteworthy astronomical events in months.

The new star, known as "Nova Pictoria," is especially interesting because it is the first one discovered long before it reached its maximum brightness. Before its outburst this star was an insignificant looking specimen of the fourteenth or fifteenth magnitude. At its maximum, it became 400,000 times brighter, and shows as a star of the first magnitude

Ancient Maya Cities Found

Coming out of the jungles of Mexico and Guatemain, the first Tulane Middle American Expedition returned recently, reporting one of the most actounding series of archeological discoveries ever made by a single expedition in six months of nerve-racking hardship the explorers located three huge centers of Maya culture, each consisting of a cluster of rained cities, containing a tremendous quantity of monuments raised with dates and hieroglyphs.

Like Columbus, who carried an Indian back to the Old World, they brought with them Tata, a pure descendant of the ancient Maya Indians. They are hoping he will divulge some of the secret customs and rites of his famous ancestors. He cannot speak a word of English

In one ancient city, the explorers discovered the first real astronomical observatory of the old Mayas to be unearthed.

Here mounds and pyramids had been constructed in such relative positions that priests could ascend the main mound and, sighting over three mounds in the foreground, make accentific, astronomical calculations. In this way they could tell when eclipses of the sun and moon were due to occur. They used this knowledge to wield power over the Indians.

Man-Made Hurricane

TO DRIVE out the potsonous carbon monoxide produced by 46,000 autos that will pass daily through the new vehicular tunnel nearing completion beneath the Hudson River, a tearing hurricane will whirl constantly through the tube. A unique system of vantilation approved recently solves the last important engineering problem of the great tunnel.

Immense electric fans will drive a 75-mile gale through a seven-foot airway under the traffic road. It will reach the road through slots and be despersed by a baffle plate. The used air will be sucked out through ceiling vents and will enter another immense airway leading back to four ventilation houses, two on each side of the river, where will be located the machinery for taking in and expelling the air

New Process Hardens Lead

WHAT generations of scientists have tried to do since the days of early Egypt and failed, has at last been accomplished, it is reported by the Western Electric Company. A method has been found to harden and temper lead. R. S. Dean and W. E. Hudson, of Chicago, metallurgical engineers, discovered the process largely through accident.

A small percentage of alloy is used and the metal is treated by a special besting process that results in a metal three times as hard as ordinary lead. One of the uses for the new metal is sheathing for tele-

phone cables

Monkey Farm for Research

TO FIND out the truth about man and monkey—just how much monkeys actually resemble men in their growth and habits, Johns Hopkins Medical School in Baltimore has just established a monkey farm, where the animals will be attuded intensively

Hitherto, most of the monkeys with which scientists had to work were dead ones brought back from expeditions to the East. But the hunters knew nothing about the history of the animals they shot. On the monkey farm it will be possible to keep track of each specimen, its age and diet, so that an animal may be taken for study at any stage in its development.

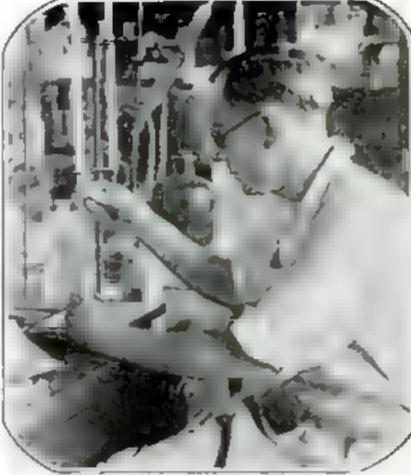
Comparison of monkeys with human embryos is expected to give important evidence of their relationship. A very closs watch will be kept on the social life of the animals. Investigators will try to discover the reason why so many monkeys die before birth—a discovery that may be very useful to man.

Flame in Water

SUBMERGED in water, an oil dame invented by a Beignan scientist, Oscar Brunler, will burn for weeks without going out, it is claimed, and so avoid most of the heat loss of an ordinary boiler. A device similar to a carburetor blows a spray of crude oil

mixed with air into the burner under pressure. Water is kept out of the burner until the flame is well started, then allowed to rise around the flame and cover it.

In all bollers loss of heat is avoided by bringing the flame of the fuel into the closest possible contact with the water. The Belgian inventor is said to have obtained almost perfect efficiency by putting the flame directly in the water.



Synthetic Insulin Made Possible

Bulk production of synthetic insulin for the cure of disbetos is promised through the work of Dr. E. M. & Gelling especiate professor of pharmacology at Johns Hopkins University Baltimore and Dr. John J. Abel. Here is Doctor Gelling experimenting with the new tondin product in his substatory.

A Dog without a Bark

A BARKLESS dog emerged from a clinical demonstration conducted by the American Veterinary Medical Association at Portland, Orog., recently. The barking apparatus was removed as easily as tonells, the veterinarians declared. Such an operation, they say, would be the means of saving the lives of thousands of dogs who make intolerable nuisances of themselves by constant barking

Serums for Snake Bites

Will the entire population of a big city, Raymond L. Ditmars, curator of reptiles of the New York Zoological Park, left recently for Brazil. The quart of venom he carried represented the production of 2500 snakes since early apring

It will be used in the manufacture of serum to combat snake posson, a process that is developed much further in South America than in the United States. The venom first is injected in horses, which produce the protective serum.

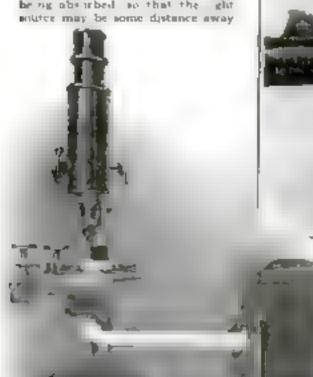
More than 100 persons die every year in the United States from snake bites, Mr. Ditmara explained, and the supply of serum from South America, given out free by the 200 hast year, was insufficient. To be most effective the serum should be made from the venom of the same kind of anake against whose bite it is to be employed. On his South American trip Mr. Ditmara hopes to obtain serum spacifically for use against the bites of North American spakes. If given an injection of the serum within an hour after having been bitten by a make, any one will recover almost completely within 24 hours, Mr Ditmors says.

The August issue of POPULAR SCIENCE MONTHLY described the interesting methed by which Mr. Ditmars' quart of enake

venom was collected.

A Remarkable Microscope

New secrets from the model of the refer tely small acon may be revealed through a new method of illumination for microscopes, many reduction for microscopes, many reductions for microscopes, many reductions for microscopes, many reductions of through a new quarty red ambust being absorbed to that the glit milities may be some distance away.



Before the Bullet Emerged

The remarkable photograph above shows the mustle of a 45-cellbet may be been fired and before the belle energies. In a case as new of a times taken with a new electrical timed apparatus recently perfected by Philip P. Quiryla, of the U. S. Burena of Standaris, which makes it possible to me he release of gas and wound waves from meapons and throws new light on the theory of boilistics. The heavy cercle seem in the photograph is a sound wave.

Woman Invents Household Budget Machine

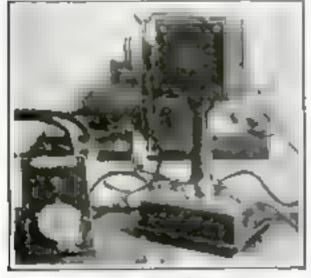


Demonstrating the new budget mechine

Instrument Registers Telephone Calls Automatically

NO MAN ever really is satisfied that he has not been charged for more telephone calls than he has made. This simple apparatus, launched by a French inventor, makes the checking an easy matter

An automatic register is adjusted to the telephone instrument. After each call you press a button and the machine does the rost. At the end of the month you read off the figures in the slot. It is arranged for a four-figure number, which meets requirements for most telephones.



Arrow points to telephone register

Shoes Respond to Changes in Weather Conditions

GRANDMA says that it is going to rain, and it does. How did she know? By her corns. Isn't that wonderful? No, not particularly, for scientists have just pointed out a direct connection between shoes and weather. Changing amounts of musture in the atmosphere cause leather to shrink or expand with corresponding degrees of comfort for those with tender feet.

Bome leathers are much more comfortable than others, for they are more porous. Feet must breathe, and if the shoe leather is loaded with finishing materials, oil or wax, it will not admit enough air to evaporate foot perspiration. Patent-leather shoes keep perspiration in and air out. If they could be worn with the shiny side in, they would be three times as comfortable as with the shiny side out.

IT'S all very well to say "keep a budget." But when it comes to figuring out just exactly how the dollar should be split, the average homewife gets duty)

A whirling device, invented by Mrs. Annie Peaks Kenny, of Chicago, adapta itself with a surprising flexibility to the changing needs of the budget keeper. An electric motor turns various sets of figures on a revolving drum so that they appear in a window next to a list of stationary captions of the main class of expenditures.

As conditions after—for instance, if the family becomes larger—the arrangement of figures changes. The whirling has a range of from one to four persons and handles incomes from \$100 to \$1200 a month



Piano Ashtray Ends the Smoker's Dilemma

ASHES on the piano keys—it's a way to incite the wrath of any wife Smoking doesn't go with piano playing, yet it is done, and the instrument is so peculiarly built that there is no convenient place to set an ashtray

A new tray, invented by Dr. Charles A Greens, of New York City, clamps on the edge of the piano as shown in the above picture. It is padded so that it will not may the finish and may be fastened on thicknesses varying from half an inch to three inches. It will clamp also on tables or arms of chairs and has the added advantage of not tipping over unexpectedly.



Improved Tin Can Has Shiny Aluminum Lining

PRESERVES and fish put up in tin cana commonly tend to turn the inside of the can black. While this is not harmful, and the food itself is not discolored, yet the blackened metal causes some persons to mixtrust the food. Lining the can with paper prevents the blackening, a method that is used quite generally in packing fish

A French inventor has devised an improvement on this by lining tin cans with thin sheets of standards. His apparatus works by means of compressed air. A pile of sheets of aluminum is stacked on a stand at one end of the apparatus. The top sheet fits around a metal form the size of the can to be lined. The tin can then is slipped over the form, as shown in the sacture above.

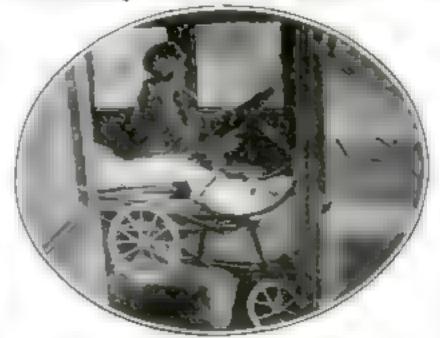
A small compressed-air tank operated by striking a plunger with the hand, supplies compressed air to the interior of the form. This forces the aluminum lining to adhere to the interior of the can. It makes the food look much more appetizing.

Torpedo Guided by Wireless for Aerial Defense

A TORPEDO directed from the ground by wireless, that is said to be capable of destruction in a radius of 100 miles from the firing base, is the remarkable invention designed by Captain Albany Roberts, of New Zeuland. It is being investigated by the British Minustry as a successful defense against future air raids.

The torpedo can be sent in any direction in the sir, it is said, and maneuvered as the operator controlling the wireless apparatus on ground desires. It has a safety device to prevent the torpedo from exploding below a certain silutude.

The Baby Now Can Motor in Perfect Comfort



The unto-exeringe fits energy in the car

THE baby now can go matering with more comfort than grown-ups, for inventors have devised a combination baby-carriage-crib and high-chair all in one. It fits inside of any automobile, either in the front or back seat.

It may be fixed so that the baby can sit up in it or, if he is tired and sleepy, a catch can be released that turns the chair into a crib. At the end of the destination it becomes a carriage. The standards on which the carriage rests are adjustable to various depths.

Novel Alarm Scares Burglar with Loud Blast

THE burglar who opens this door is going to have the surprise of his life Attached to the end of a chain that fastens across the door on the inside is an explosive cartridge. This is hung on the door.

Any one entering, unaware of the presence of the siarm, pulls the end out of the cartridge. This explodes a charge of powder, making a sharp but harmless blast intended to frighten the prowler away and awaken the household.

Analyzes Fruit Juices Cooked in Metal Containers

IN MANY households kettles and other kitchen utennils of iron, copper, brass, or aluminum are used for boiling fruit juices, sour or salty broths or stews. In view of the fact that nearly all easts of metals are more or less poisonous, Mr Jarvinen, chemist of the municipal laboratory for hygienic research in Helsingfors, Finland, undertook a series of tests to ascertain the quantity of different metals dissolved in the liquids kept boiling in metal pots.

Two pounds of fruit jules, containing 40 per cent of sugar and 1.5 per cent of citric acid, was kept boding in an Iron pot for three hours. At the end of that period it was found that the liquid contained 1400 milligrams of iron in solution. If, in place of the sugar solution, a 5 per cent solution of kitchen salt (sodium chloride) was used, the liquid, after three hours of continuous boding, contained only 104 milligrams of iron in solution

Under the same experimental conditions, fruit juice boiled in a copper kettle dissolved 65 milligrams of copper; that boiled in a brass kettle, 0.5 milligrams of cupper; and that boiled in an aluminum kettle, 120 milligrams of aluminum.

Adjustable Lap-Desk an Aid to the Student

A DESK that rests in the lap and can be adjusted to any angle permits the user to read or write with comfort, or to study with correct posture. It can be used in bed by sick persons or those who like to read while lying down, by artists, stenographers, and draftsmen.

It consists of two boards joined by six legs with ball-and-socket-joint connections. The desk can be locked in any desired position and weighs very little, so that it can be carried easily from place to place.

First Rural Air Mail

WHAT is said to be the first sirplane rural mail route in this country was started recently in New Hampshire. Newspapers and letters were carried 43 miles to vacation colonies on the shore of Winnipesaukee Lake.



New Pen Makes Lettering Easy for Amateurs

A NEW pen with "ball bearing" point is designed for bold lettering. It works so easily, it is claimed, that the inexperienced person can do attractive lettering with the neathers of a professional

The point prevents spattering of lnk while the pen is pushed backward or forward, keeping the letters neat and clear cut.

ABOUT 415,000 long tons of rubber were produced in the world last year and the United States used 77 per cent of it, compared with 45 per cent in 1905 when world production approximated 60,000 long tons.

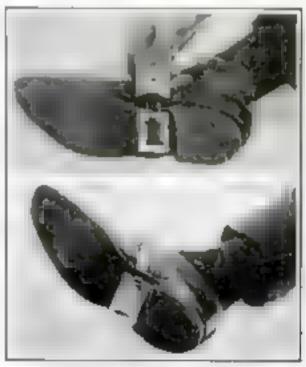


How the deak reers on the kness

New Ice Creepers Detached from Shoes Quickly

WHILE spikes for the shoes are often very useful in winter when the walking is slippery, in the house or store they are ruinous to floors and rugs. Yet for the man who must go indoors and out many times a day, repeated removing of ice crospers is a numance.

A new ice creeper has spikes that may be detached without removing the greeper



Above: How the ice creeper is detached. Below: The creeper in place

from the abos. Pressing a spring releases the tengue of the spike plate from a groove in the part strapped to the foot. Replacing the spikes when going outdoors takes but a moment.

Crawl Stroke for Motorboats

THE Australian crawl principle that produces some of our fastest swimmers now has been applied to motor-beats. A new propeller invented in Austria resembles a pair of double fins mounted on a horizontal shalt in the same position as a screw propeller. These do not rotate, however, but oscillate, suggestive of the kick-stroke of the crawl

The new propellers are said to save fuel, conserve power, and increase speed. They may be used also, it is claumed, on

airplanes and dirigibles.

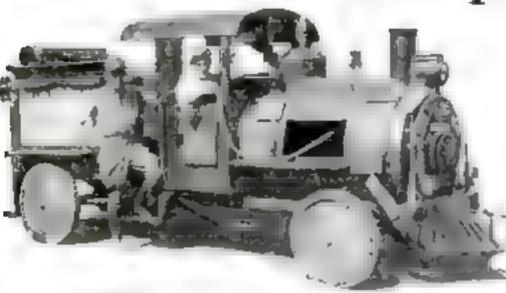
Radio-Active Water Produced Artificially

T'HOUSANDS throng every year to health resorts famed for the radio-active water from their oprings. Now a health spring for the home is said to have been achieved by the invention of a new water container Road with porous radium ere. It is said to import to drinking water coming in contact with it radioactive properties needed by the body. The photograph shows James J. Jeffries, former world champion heavyweight boxer (center), with two young pugilists, sampling the treated water



"Jim" Jeffries (center) and two pogliks sampling the water

Novel Machines Built Out of Scraps



Odd "Gas Locomotive"

In this odd vehicle made from an old auto chasse and odds and ends from the junk pile, C. D. Conklin and W. J. Bellers, war veterans, recently toured from Los Angeles to Washington, D. C.



With the sid of this "rubber man," made from the inner tube of a discarded flivver tire, E. F. Wasco, a timber faller in a lumber camp near Bend, Oreg., has broken all cutting records for his district. The rubber man is attached at one end to a cross-cut saw, and at the other end to an iron stake driven in the ground near the butt of the tree



A few boxes, a broken table, and an old bleycle wheel were used by George Foster of Brewster, Mass., to build the unique windmall above. Cape Cod winds are all the incentive needed for this faithful servant, which pumps water, saws wood, turns the washing machine, and does a score of other bousehold tasks

A Bicycle Lawnmower

Half a discarded bleycle was put to good use when it was attached to the lawnmower, as shown, by Victor and Richard Dorn, of Red Bank, N. J.

Builds Ditching-Machine

Almost every kind of junk was used by H. O. Dahlin, of Woodford, Wis., an constructing this ditching-machine for his farm. An old auto furnished the differential and transmission



Motor Home from Scraps

From cast-off parts found in alleys and punk piles, A. L. Campbell, a salvage engineer of Chicago, and his 16-year-old son, put this house on wheels together in their back yard. It has running water, four berths, a dining-table, ice-box, bathroom equipment, and electric lights

Some Queer Ways to Get About

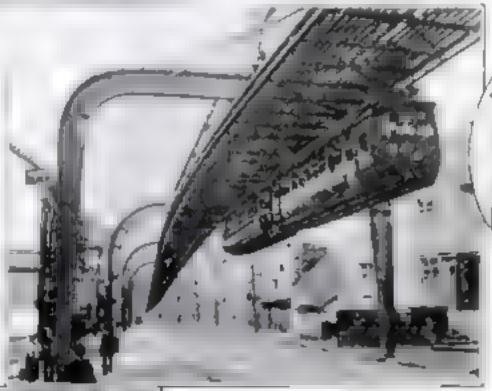


Why a Motor?

to man, arets or George C Server New York engineer byente, this mal and eless make a ver proper bythe . Hyer a weight on an arrangement f geate! trendways. He says it can go 30 miles an hour

A Monorall "L"

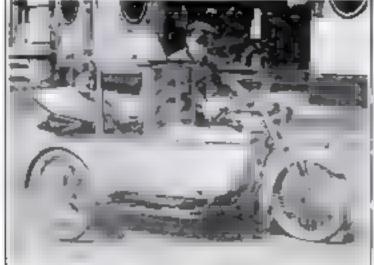
At the right is a remarkable menoraliway just completed between Vohwinke' and E ber feld. Germany rolly fr in which the core having are intepertued from steel arches



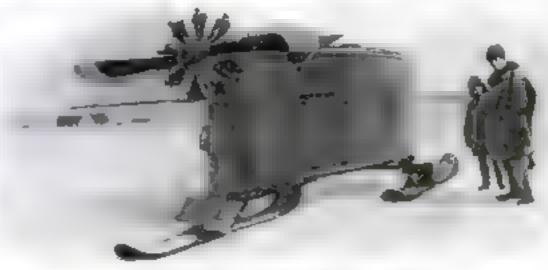


A Real Joy Ride

The latest man vation in kid heaf tricycles, a thin morphism, vencer pedew thattle sidecar attached. Son takes sister riding now



Three-Wheeled Taxi Proves Popular Midget motorcycle sidecar taxis such as this have become popular recently in Berlin, Germany, because of their comparatively low cost of operation



Air-Driven Ice Bus Runs on Skis

Mounted on three skis and driven by an airplane propeller, this anugbus carries passengers between Helsingfors and Sveaborg, Finland

New Time-Saving Tools

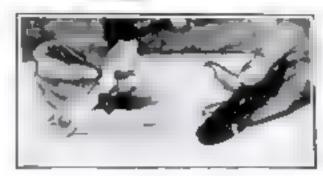
Power-Driven Tool Cuts Out Viortar between Bricks

IN POINTING up bricks, a new and ingentous machine is used for cutting away the old mortar between the brick construction joints. A one-quarter-homepower motor operating at 3500 revolutions a minute drives the cutting wheel.

> The shaft, which is connected directly with the motor, is provided with a metal-wound casing and also a hand piece and safety guard for protecting the operator's hand from flying chips.

Special rubber bond wheels, of various widths,

are used in order to handle different widths of mortar encountered in the various types of brick construction.



Combination Vest-Pocket Tool Is Handy for Radio

TWO slotted strips of metal hinged together have a surprising number of uses. The device is a combination tool for radio fans, electricians, mechanics, automobilists, or artists. It may be used as a ruler, wire cutter, wire stripper and cleaner, accordingly wire, wrench, counter unker, and is especially handy for working radio panels.

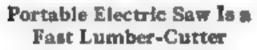
The tool fits into a small leather case that slips easily into the pocket.

Vegetable Ivory Resembles Elephant-Tusk Product

VEGETABLE ivery is one of nature's wonderful products that may be used, it has been discovered, for practically everything for which tusk lvery is used. It is derived from the nut or seed of a paim, that grows in Central and South America. The seeds grow in the fruit or head of the paim, which is about the size of a man's head and weighs from 25 to 30 pounds. Usually a head contains from 40 to 50 nuts.

The seeds are solid, white, and hard and, when polished, scarcely can be distinguished from animal ivory. The unique product is used in the manufacture of door knobs, umbrella handles, and small ornaments, but its chief use is in making buttons. These ivory seeds form the chief industry of the interior of Colombia.

The United States imports more of this ivory than any other country.



FOR ripping or cross-cut-saw work, a few years ago anything was good enough. But an old hand saw meant slow work and worn-out workers. Now a new portable electric saw team through thousands of feet of lumber a day, it is claimed, cutting production costs.

It may be used, also, in cutting bone, wallboard, plaster-board, fiber, lineleum, hard rubber, light-gage soft metal, and bakelite. It is provided with a dust shield which can be removed without the use of any tools. It operates from any light socket and is used with either six-inch or seven-inch blades.

Fine Wires Prevent Breaking of Windshield Glass

A NEW plate glass for automobile wires running parallel to each other at intervals of two inches. Recent tests showed that such material would minimize the danger of injury from flying glass in case of accident. It stood both shock and impact without shattering, although of course it cracked when a metal block weighing 8% pounds was thrown against it at close range.

Eight-in-One Wrench Useful for Adjusting Spark Plugs



HERE'S a wrench that is said to be one of the handlest of tools for the automobilist's outfit, besides being useful for other purposes.

This recently devised socket wrench takes up

little space in the automobile tool-kit and fits almost every nut on the car, thereby saving much time for the amateur mechanic. It is eight different wrenches in one.

It is especially useful for fitting on spark plugs, it is claimed by those who have used it for this purpose. The illustration shows how the wrench fits on the spark plug.



Cutting out morter with power tool. A marry guard protects operator's hands

New Taper-Gage Measures Odd-Sized Holes

To MEASURE accurately small holes that vary from standard plug-gage sizes, a new set of taper parallel gages has been designed. These are especially handy in a small shop where a complete set of plug gages is not kept on hand. They are

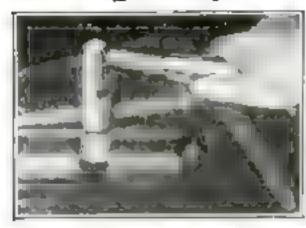
useful in checking out-of-the-way holes that sometimes are hard to measure on jig and fixture work.

The gages are used in pairs to measure holes from one-quarter to one inch by thousandths of an inch. Two gages fit into the hole snugly and their combined thickness equaling the diameter of the hole, is measured with a micrometer



Espensing adopted for small sleep use in the mew taken gage that the asking a strate below when standard we have tells whether the hole or out of sample A we of the gages is above in box at 100

Simplify Old Problems



Universal Auto Wrench Grips Hard-to-Get-At Nuts

THE head of this wrench can be set at any angle and as there is a reversing ratchet built in, it is said to be especially useful wherever nuts and bolts are hard to get at

Automobile design often requires that some of the nuts be placed where ordinary wrenches cannot be used. This wrench will do the job easily, it is claimed, without marring the edges of the nut. There are also extension pieces that can be attached in a variety of ways to meet practically avery need.

Elevator Telephones Assist in Avoiding Disputes

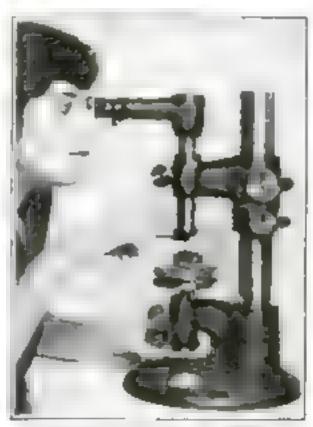
NOTICING that apartment-house tenants seemed fond of airing their troubles to elevator operators, the owner of a de luxe apartment house in New York City installed an unseen telephone in the elevator. As a tenant rides up or down in the elevator, she unknowingly talks to a young man at the other end of the line, who is sitting out of sight in the entrance hall below. If she tells him about the burned-out fuse, or the leak in the sink, the matter is attended to at once, and the apartment-house geam shift amouthly. It is a great success, according to reports, in keeping the tenants content with their landlord

Measures Twenty-Thousandths of an Inch Accurately

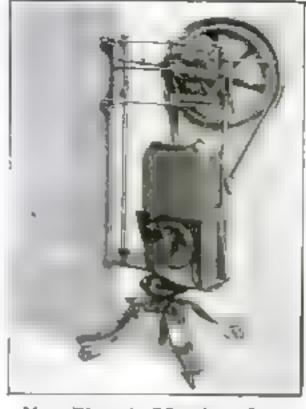
MOST methods of measuring extremely small distances are slightly inaccurate. In micrometer acrews, for instance, oil films between the lubricated parts sometimes affect the measurement. It is very difficult, too, to get markings on dials that are exactly correct,

A recently invented instrument called an "optometer" is claimed to measure 1/20,000 inch with exactitude. The scale itself never is moved or touched, but merely is observed through a microscope. To the eye the 1/20,000 inch appears to be one-exteenth of an inch.

The readings are not affected by variations in sense of touch or differences in human skill. In measuring infinitely small parts of an inch, the results of this instrument may be relied upon absolutely, the inventor claims.



In this cemericable measuring contrament the scale is read through a microscope



New Electric Mortiser Cuts with Automatic Precision

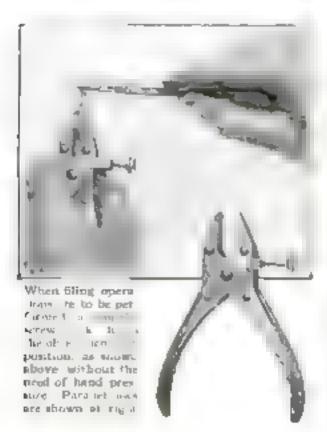
To REPLACE the slow and costly hammer-and-chisel method of out-ting mortises, an electric motor-driven machine recently has been put on the market.

With this it is said a perfect door-look mortise can be cut in two or three minutes. It can be used on thin pieces such as screen doors, as well as on wide and heavy boards.

A bit of the proper size is inserted in the mortiser and the machine set for the center position and length of the mortise. A depth step is set so that the machine is halted automatically when the machine has cut to the proper depth required by that particular piece of work

A NEW substance in paste form for adding to concrete mixtures, it is claimed, hardens and colors them at the same time. It also waterproofs the concrete to a certain extent. It comes in red, brown, green, and several other shades. Thus, by the use of this new substance, it is possible to color and harden concrete floors in one operation.

Hand Vise and Pliers Skilfully Combined



A NOVEL tool that combines pliers and a hand vise is the recent invention of W. A. Bernard of New Haven, Conn., who has made a life study of pliers. The tool is fitted with a thumb screw, which when backed out as far as it will go provides a pair of parallel jaws for ordinary use around the workbench or the automobile.

Often, the uper of pheta finds it necessary to hold them in clamped position for several minutes at a time; as, for instance, in filing a key blank to the outlines of another key. A thumb-acrew lock on this tool makes it possible to retain one or more objects firmly in position after the hand pressure is released. Thus it is especially useful where several operations are to be done without the necessity for releasing the work.

Filing operations on round stock are said to be greatly facilitated. The tool comes in handy also, it is said, for soldering small parts of a teachine, engine, or radio set.

Inventa Puller to Remove Battery Connectors

CONNECTORS
on the terminal posts of storage
batteries often become corroded and
difficult to remove
with acrewdrivers
or other tools commonly used for the
purpose.

Clarence E, Moss, of Ponca City, Okla., has invented a tool that makes it possible to pull off the terminal connectors easily

As the photograph at the right shows, the device consists of a pressure bar in the middle bearing directly against the battery terminal, and jaws with a claw hook that fits under

the lead terminal of the storage battery.



New Household Helps for

Work Is Lightened by the Use of the Best Tools and

Rug-Cleaner Has Six Rotors

A new rug-cleaner is said to work wonders in beating out dust by means of six small rotors. It is claimed that dust rolls out after the device runs over the rug several times

Pincushion Straps on the Wrist

While shows on the wrist, this handy little pincushion is adjustable as well to a dressmaker s or tailor's belt or any handy part of the clothing, and saves many motions in making a garment



Easily Opened Bottle

In a new type of bottle recently developed, a coin, knife, or key, or any flat piece of metal will remove the cap with case. The rim has a ledge below the cap so that the opener acts as a lever



Pictured below is pail polish in stick form, that unwinds as it is used, somewhat as paper leadpencils are sharpened. The buffer beside it is a new espitary one that is readily adjustable to that a clean chamois for each manicure is possible



One More Biscuit-Cutter

Blacuits in a jiffy. Every time the little device illustrated below revolves, it cuts out a biscult or a cookie. It is made of aluminum and in consequence



Baby's Bath and Dresser

This new rubber buthtub for the buby saves the mother from bending over One end is a dressing table whole can be folded into a compact



Locking-Dog Folls Burglar

This strange device is a locking-dog, and its purpose is to feil burglars. It is pushed into the keybole after the door is locked and the key removed. A padlock makes it secur

A Square Cooking-Spoon

The square edges of this new cooking spoon scrape the corners of a pan or a duh, and prevent the burning or sticking of food. Perforations in the bowl of the epoor. allow the liquid to escape when solids are to be tested. The spoon may be used also as an egg experator or for draining off liquid



Stones Two Cherries at Once

Cherries are fed into the trough of the povel cherry stones pictured at the left, and fall into two holes. When the handle is raised, two prongs close into bales, forcing out the cherry stones

the Woman in the Home

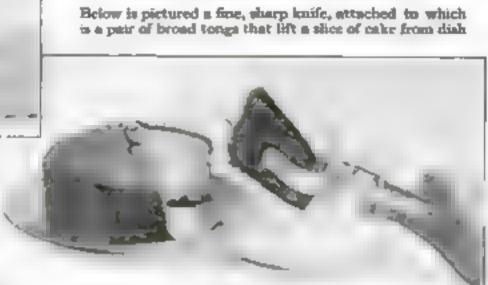
There Is a Constant Supply for Every Need



Simple Steel-Wool Holder

Steel wool is extremely useful in the house, but it often injures the fingers. The illustration at left shows a steel-wool holder with a new wad of wool being tucked into the groove

Cake-Cutter Is a Lifter, Too



No More Towels on the Floor

Somny pulls at the towel on its gravity rack. But the pull merely tightens the rack's hold and locks it automatically until mother wishes the towel removed from the rack



Silenced Placed in between the window

Rattling Windows

strip and frame, the little de-vice shows below quets a rattling window in a jilly. It can be attached permanently to the window frame or merely pushed in when it is needed

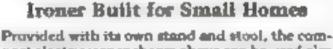


Metal Spoon Is Good Mixer

A wide metal spoon with slots is designed especially for cake-mixing, but it also beats en casy grap on the big grooved handle



The handles of the cuttur below are closed and the device is forced into the top of a grapefruit. In the fruit, they are opened and when with drawn, bring out the core



pact electric groner shown above can be used also as a trousers press, by making the padded rolls become stationary



Cedar Egg for Moths

Among the numerous remedies for discouraging moths, the latest is a cedar ball that may be hung up in a cicthencloset, in which case it is provided with a book. It is easid to last for a long time

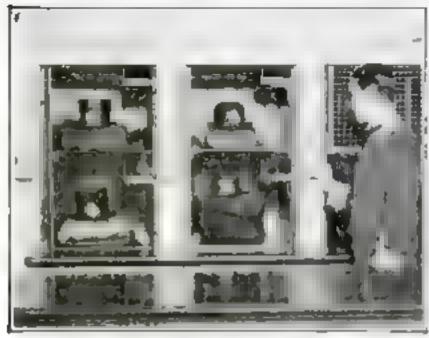




Mixing-Bowl or Pulverizer

In jelly season this novel food pulverizer can be used as a fruit press. As a vegetable press, sieve, colander, ricer, or to make bread-crumbs, it has many every day uses. The frame that holds the bowl is held firmly to the kitthen table by means of thumb-screws

Electric Elevator Delivers Hats and Coats



The footmen presses a button to set the elevator in motion. It travels up and down at a speed of 70 miles un bour

"HAT and coat, sir! Your check, sir!" and the footman present a button and opens the door of an electric elevator. The hat and coat come into view and are delivered to the waiting owner.

This elevator, which does away with the check room on the main floor, was installed recently in the Savoy Hotel in London. It is said to attain a speed of 70 miles an hour and to handle 1000 loads an hour. Notice that there is a place in each compartment for the Englishman's indispensable waiking stick.

Billiard-Cue Tips Fastened by Ingenious Joint

LEATHER tipe on pool or billiard cues have an annoying tendency to drop off at an exciting part of the game. H. L. Wheeler, of Springfield, Vt., recently invented a new way of applying the tipe to avoid thus. The point of the cue is turned with a cylindrical projection that fits into a recess in the tip. The tip then is applied with glue in the usual way, but the method is said to provide a much firmer joint than the conventional method.

If the tip should break in a game, another can be put on and will stay fixed for several games without glue, the inventor claims. The tips are made in many different styles.

Uncle Sam Trying to Make Dollars Last Longer

HOW to make one-dollar bills last langer is the subject of intensive experiments now being conducted jointly by the U.S. Bureau of Efficiency and the Bureau of Standards.

Twenty carloads of these hills are manufactured by Uncie Sam each year. Due to the quality of the material new used, they wear out sooner than the experts think they should, and must be replaced. At present the paper money is made from rage—about 75 per cent linen and 26 per cent cotton.

Experiments are being conducted to see if the government cannot employ stronger bases, such as wood pulp, Manda hemp, African grass called esparts, and Kansas wheat straw. The government has its own paper-making machines, which can produce paper from various materials.

Hammer-Head and Handle Forged in One Piece

A HEAD that cannot fly off and a handle that cannot break are the advantages claimed for the new type of hammer pictured below. The handle and head are forged in one piece of steel. The end of the metal shank is covered with wood to provide a good grip.



Pulling a nail head through the wood with the new hummer, welded in one piece

"Beef Extract" Manufactured from Fish Refuse

A WAY has been found to make an extract resembling that of beef out of fish refuse. At Boulogne-sur-Mer, France, tons of refuse left on shore daily by fishing fleets used to be given away to fertilizer manufacturers. In the future these manufacturers will have to compete with a canning company that wants it for the new food product. Rights to make the extract have been obtained for the United States.

Autograph-Telegrams Popular

BELINOGRAPH, the system of sending photographs of autographed telegrams by wire, is becoming popular in Europe. The cost of sending an autographed telegram has been reduced in France to 25 cents.

Many advantages are pointed out for this new type of telegram. Messages need not be translated for transmission One hundred words can be written assily on a form and go as a single photograph. The sender can be sure that his message will be delivered exactly as he wrote it and the receiver can identify the sender by his own signature.

Moreover, the transmission is declared to be very rapid.



High Seat for the Baby Will Fit Any Chair

A NEW high-chair attachment provides a seat for the small child any time, where ever an ordinary chair is available. It has rubber-covered ateel hooks that fit over the back of a chair and are adjustable to various makes of chairs. Made of canvas, the attachment folds into a small package easy to carry when touring or traveling.

New Portable Arc-Light Uses Minimum of Current

THE remarkable feature of this new portable are-light, designed for use in photography or for producing stage lighting effects, is the fact that it uses only six watts of current.

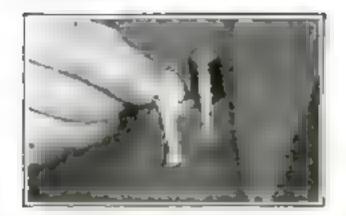
Various types of portable are-lights have, of course, been in use for many years, but this is the first model that uses only one-seventh of the power required to operate ordinary electric-light bulbs such as are used in houses.

A New Goa Mosk

A GAS mask that produces its own oxygen has been invented by H C. Carter of Victoria, Australia. Renewing gas in masks long has been a difficult problem in masks used by miners and divers.



This picture was made with illumination from a portable light like the one shown here



Vest-Pocket Savings Bank Holds Four Dollars in Dimes

A VEST-POCKET bank to eatch stray dimes before they slip away, clips on the pocket like a fountain pen. It is only four inches long, and because it is wedge-shaped so that the dimes stack up at an angle, its thickness is not more than half an inch

The little bank will hold four dollars. A woman can ship it into her handbag. The bank is locked with a snap-spring which is opened with a key

Oar-Propelled Kiddie Cart Gives Rowing Exercise

WHILE physical instructors generally agree that rowing exercises more muscles of the body than almost any other aport, it is one form of exercise usually denied to children. Boats are too heavy for their strength.

A new play cart gives the rowing exercise on dry land. Except that the child sits facing the "how" while pulling on the oars, the movements are the same as in rowing a boat. The little cart is driven forward from a sprocket drive on the rear axle, the chain being pulled by the "oars," which must be raised before sliding back to first position.

Stearing is done by the feet. The cart in furnished with a slide sent, if desired

When your fountain pen runs dry and you have no way of filling it, usually you can obtain a supply of writing field simply by fining the tube about half full with water. As a rule, there are enough ink crystals in the tube to make a fairly good writing field.

This Novel Ashtray Holds Cigarette Extinguisher

A COMBINATION eigarette extinguisher and ashtray is made of nonbreakable, washable porcelain anamel.
It cannot tip over easily. When the
amoker finishes a cigarette, he simply
drops it, lighted end first, into a tilting
tubular receptacle, where it is quickly
extinguished. The receptacle then is
emptied simply by flapping one end of
the tube with a finger

The rim may be detached from the tray for cleaning.

The amoles eigerette is estinguished simply by dropping it in the tilting tube at left

New Safety Fire Hydrant Is Shock-Proof

SHOCK-PROOF fire bydrants were installed recently in Los Angeles, Calif If a careless motorist knocks one of the plugs out, a safety valve in its base automatically abuts off the flow of water.

Another advantage is a valve arrangement that permits a fire engine to be coupled to the hydrant without shutting off the water. In the photograph Battalion Chief Blake of the Lon Angeles fire department in seen testing one of the hydrants.

Discovery of a solder suitable for welding aluminum recently was reported from Germany it is said to be composed of seven different metals.



Bettaken Chief Blake of the Los Angeles Fire Department (at right) demonstrating the automobile-proof hydrant

Pulling the little care proprie the care forward. Beering to dotte with a big feet

Safety Key for Oil Tanks

TO PREVENT explosions caused by static electricity generated in filling a motor-tank truck with oil, a device has just been perfected in the form of a key that must be inserted in the cap and left there, in order to open the tank. This key is grounded so as to lead off any electricity generated.



The designer concerves new designs by mosing at order and ends of salk and metal through a tube containing haleidoscopic microra

New Compound Kills Weeds in the Garden Path

UNSIGHTLY weeds along the garden path are doomed, according to information from Germany. Certain compounds have just been patented that may be added to the gravel before laying the paths in order to prevent any weeds from growing, or they may be powdered or sprayed on the weeds to kill them. The most potent of these compounds are the sodium and calcium paratoluone sulphonomides.

Vast Supply of Potash

A THOUSAND years' supply of potash for the American farmer, making us independent of supplies from Chile and other foreign countries, is possible as a result of a discovery of a new process for making potassium sulphate from greensand. Large quantities of this peculiar type of sandstone are found in Delaware, New Jersey, and Maryland near the surface so that it can be worked with steam-shoves.

Original Designs Created by Kaleidoscopic Tube

THOSE who figure out our designs for dress goods, wall-paper, and rugs are required to tax their imaginations. Sometimes they run out of ideas. A novel device called a "designoscope" has been invented recently to help them. It is designed to produce varied patterns and decorative motifs by means of sinul pieces of tinfoil, scraps of silk, colored paper, glass, jewels, in fact, almost any small objects.

The operator looks through a small hole at the top of a triangular tube that contains kenedoscopic mirrors. The scraps of material are placed upon a white revolving disk directly below the tube. As these whirl around, the operator sees an ever-changing combination of colors and designs. The apparatus makes an entertaining toy, as well as serving its utilitarian purpose, for its possibilities are practically unlimited



Some Thrilling Parachute Jumps-



Photos Developed in Flight

Arms the typopies is we have a serious and a



Jump from Balloon

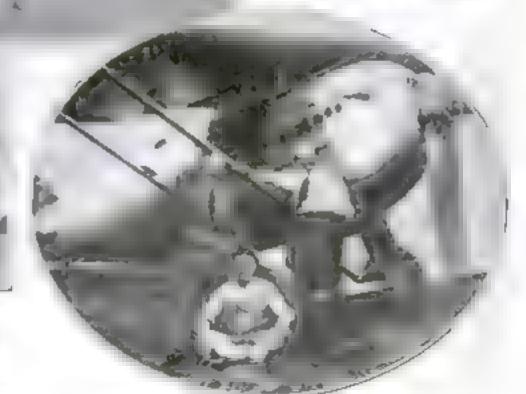
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To Cross Attractor



An Instant Later He Hit the Roof

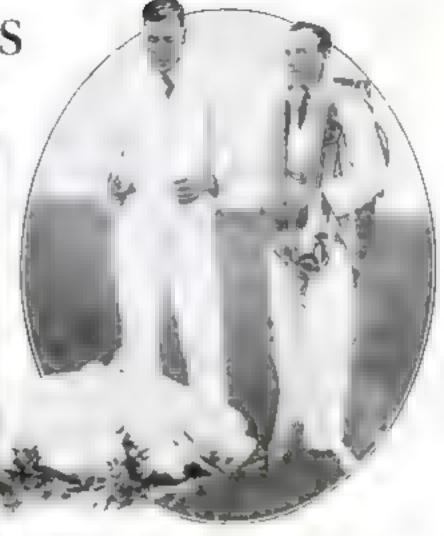
When A! Rec as large start? It is specially plane alse ve S. n. brance. In the start is a property of the was healy represented. This analysis property downs. Reeves an instant before he landed in the chieff of the start.



Mark Air Progress

The Latest in Motorless Gliding





Safe on Earth-The Two Jumpers

Here are the two femous parachute jumpers, Lyman Ford and Alga F. Starr, just after a part of the second thrilling jump from the lil-fated Shonandnah, at Lakehurst, N. J. Ford's parachute is at his feet, while Starr is showing how he carries the umbrelia on his back.

A Cameraman's Perilous Perch

Here are two of the last pictures taken of the Shorandonh before her tragic crash in Oh. Abov. J. in Done in the contrague of part of the contrague of the cont



A Fire Ladder to the Rescue

The photograph below shows how a fireladder apparatus was used in an attempt to repair the netting cord of the army beloom 8 16 after it had been broken by a gale. The extension ladder was found to be the only means of reaching the break without damaging the expensive gas beg underneath

Motorcycle Lifts Glider

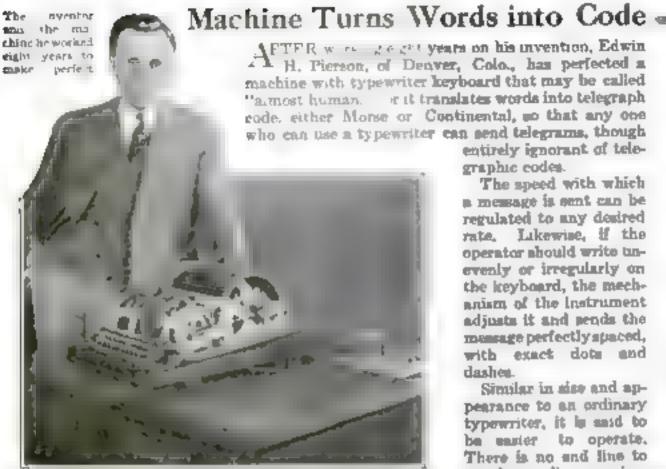
In latest experiments with motorless gliders, German aviation experts have developed this new method of hopping off A motorcycle hitched to the glider pulls it along the ground until it has attained enough speed to rise. When the machine is aloft, a touch of a lever releases the tow rope and the glider soars on its own



When bot in and

he stew district

can be usued up



Typewriter transmits telegrants in Morse or Continental

a message is sent can be regulated to any desired rate. Lakewise, if the operator should write unevenly or irregularly on the keyboard, the mechanism of the Instrument adjusts it and sends the

entirely ignorant of tele-

The speed with which

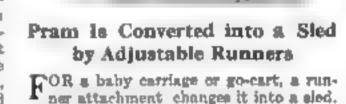
graphic codes.

mensage perfectly spaced, with exact dots and dashen.

pearance to an ordinary typewriter, it is said to be easier to operate. There is no and line to watch, nor line spacing.

A Five-Pound

Similar in sise and an-



the lower portion of the wheels, out of the way They may be clamped easily to the axle of any go-cart. It requires but a

The runners are lowered by a lever at the

back of the carriage. When not in use,

they are folded easily and raised above

Ingenious Instrument Shows Position of Ship at Sea

few moments to prepare a sled for the buby.

FOR determining the position of a ship at seen, a retired Italian shipmaster, Signer Nuschak, has invented an ingenious Instrument, which he calls the "arcometer." The arcometer is a mechanical model of the firmament. It consists of two circles (meridian and equator), mounted so as to move on axes at right angles to each other. The meridian circle is furnished with a somicircle representing the horizon.

At an angle of 90 degrees to this semicircle are two other semicircles (the hours).

All these ares and circles are graduated Two micrometrical acrews, slow-motion tangent screws, and verniers are fixed at the base of the instrument. The verniers are equipped with enlarging prisms, to enable the navigator to make a reading in dim light,

One home burns every three minutes in the United States, according to the National Board of Fire Underwriters. Defective flues cause the most fires, with sparks on roofs a close second.

lieves the distressed condition and then

He Protecta Case of Precious Plumes with Poison Gas

HE down of the Maryland Academy of Smonce, Dr. Francis C. Nicholas, has originated an idea for guarding a rara collection of plumes of the bird of paradise and other fowls. The collection is in a glass case, and beads the beautiful gold and white plumes is a small vial labeled with a death's head. On the case the following notice is pasted:

"This case of plumes is protected by war gas. To open the case is to court death. The plumes have been poisoned and to handle them will result in serious

injury "

METAL foil rolled to an amazing thinness is claimed to be the product of a new process invented by Karl Meuller, of Berlin. It retains its elasticity and becomes transparent. The discovery is halled as of great use in the telephone, radio, and musical-instrument industries.

Double Door Latch and Grip Saves Irritating Delay

RYING to open a door that happens to have its thumb latch on the other side means moments of exasperation. An

Ingenious latch that works both ways and gives a grip on both sides of the door climnates these.

It can be used on any thickness of door, from 146 inches to 244 inches. Two screws at the top and bottom of each handle prevent it from working loose. A pair of padlock eyes are included with the set of intches.

The device can be med interchangeably on right- or left-hand doors, swinging in or out. It is made of

Double door handlesheavy wrought steel.



After the pictures have been taken, by

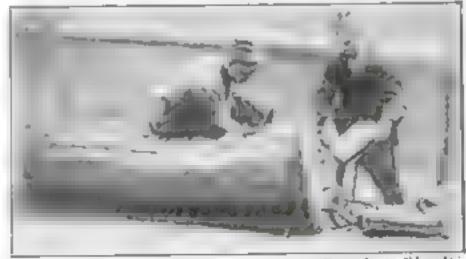
a special process the negative is changed to a positive and used for projection.

New Air-Pressure Suit Cures the "Bends"

WORKERS under air pressure are subject to the "benda." It is pro-

duced by a too sudden change of pressure and is due to the formation of small hubbles of air in the body, which press against important nerves. This peculiar cuterpillar suit is the invention of a German, who claims that a man suffering from the "bends" can be placed inside the suit and air pressure applied up to the degree he has been working under. This re-





Mothod of administering compressed air to sufferer from "bends

No more switward, portages for users of adjustable vises



Chicago Bank Employees Hold Fort against Bandits

TO FIGHT off bandits, a state savingsbank in Chicago has installed a ministure fort. A seven-foot semicylindrical ateal plate set upon a rear balcony and camouflaged to look like a pillar serves as a turret. Through a small slot in this, an employee keeps a high powered rifle constantly trained on the bank floor below. The plate is armor for the watchman.

The photograph shows a junior employee standing guard. Besides this precaution, the bank has established a regulation ride range in the basement, where all of the employees, including women, are taught to shoot. The bank has my rifles, a number of pictors, a co-

electric buttons concealed in various places that will bring outside aid if the armenal inside is not sufficient.

Distrimped has been traced to a germ similar to the typhoid-fever germ. The discase is very costly to silver-fox fur farmers, and experimenters are hoping that a remedy soon will be found to fight it now that the hacteria is isolated.

Movable Vise Aids Workmen

A CERTAIN Parts toolmaker often had not red how awkwardly men had to work on jobs held in a vise. This sometimes meant a poor shape or finish to the work and perhaps a job done over again. What was the answer? It did not take the Parts toolmaker long to solve the problem. He set a vise on a ball base that fits into a spring socket. A small auxiliary vise on the side tighters the socket and makes it immovable, once set at the angle desired by the worker. By this means awkward positions

at work are avoided and measurements followed easily.

LAYING 36,000 bricks a day, or 3 % carloads, James Brown, an Indian, formerly a football player at Carlisle, has amazed fellow workmen at Kansas City, Mo., who are convinced that he must be the world's champion bricklayer

Five men are kept boay supplying him with bricks. He receives two dollars an hour for his labor, making \$16 a day and says he believes he can even break this remarkable record when he has been at it awhile. He challenges any one to a brickinging contest.



How the new movable vies is set on its ball socket

The he of the gran eige to be

Wire-Straightening Machine Salvages Junk

MASSES of tangled wire, often thrown away, may be salvaged in a new and unusual straightening machine. It will save 95 per cent of the wire put in it, it is claimed, no matter how badly twisted.

The wire is stretched over eight rolls made of tool steel. The first two act as pinching rolls, with spring adjustment to prevent shaft strain. The remaining six rolls are staggered. The shafts are made

The shalls are made of high carbon steel. The machine will handle wire from one-sixteenth inch to three-eighth inch and from 150 feet to 200 feet a minute.

AFTER 15 years' rescarch, a new wheat,
said to be invulnerable
to block rist, has been
developed by R. S.
McFadden, a South
Dakota grain-grower.
It is a mixture of hard
red spring wheat
erossed with the
Emmeror Spletzstem,
he says-

New Garden Tool Gives a Neat Finish to Lawns and Walks

AFTER you finish mowing the lawn, there are still the edges to be trimmed along the walks. This is the most tire-some part of the whole job. Everything from a kitchen knufe to a hos is used to do the work and without very good results,

A new tool, easily operated, keeps the edges trim and clean. As it is pulled along, it cuts a narrow, even strip of the sod next the walk or curbing, leaving a shallow drainage groove, as shown in the dissertation at the left.

Forty dinessur eggs have been found in Mongolia by the Roy Chapman Andrews expedition, according to cables received from the leader of the expedition. Fine dinessur skeletons and skulls, arrow and spear points, old hearths and other archaological material, indicating a human culture of "dune dwellers" in the stone age, are other discoveries. Ten thousand feet of spectacular pictures have been taken.

Mirror Switch Plate Will Fit Various Sizes of Switches

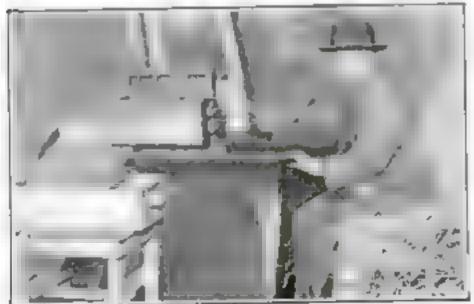
An Economical fixture recently put on the market is a mirror switch

plate that fits various sizes of switches. It has a rectangular slot that permits the use of any standard aquare handle tumbler switch

With a mirror backing, the plate fits in well with most decorative schemes, or plates can be obtained to match any color scheme desired for the home.

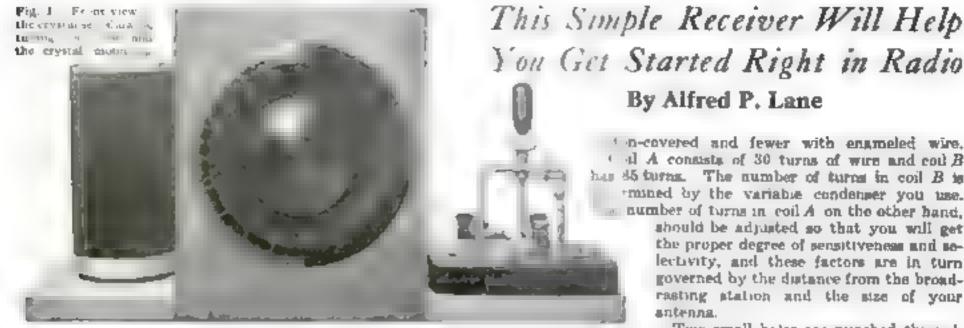


Placing new plate



This egratghtening machine salvages 15 per cent of old wire

How to Build a Crystal Set



HERE are many millions of people in this country who live within five miles or less of a powerful radio broadcasting station. And, judging from the total pales of complete radio receivers and the parts from which to make them, a surprisingly large number of these people have not yet taken any interest in radio.

Building a simple crystal radio receiver. in a mighty good way to get started in radio. You can build such a set at a minimum of expense and the upkeep cost is practically nothing. Then when you decide later to build a vacuum-tube radio receiver, the whole subject will be much less mysterious and difficult.

A friend of mine started in radio by way of the crystal-receiver route, and while he now possesses a remarkably good five-tube receiver, the old crystal set still is kept in communion and he uses it a great deal. He lives within a mile or two of one of our best broadcasting stations and when he happens to be slone at home and wishes to listen to the program from the local station, he done the ear phones, adjusts the crystal until he finds a sensitive spot, and settles back in his armchair to enjoy the music while he reads the evening paper.

AS HE puts it: "Why should I wear out my tubes and use up my betteries just to hear station WXYZ when the crystal set brings in the music with perfect quality and the ear phones shut out all the street noises?"

The crystal radio receiver shown in Figs. 1 and 4 was designed and built to show how simply and easily a good set of this type can be constructed. No tools were used other than those to be found in every household, such as a small wood saw, a gimlet, a penknife, and a acrewdriver. No soldering-tron was used and all the connections were made with the same wire used to wind the tuning coil.

Here are the parts of the set as indicated by letters on the

illustrations.

A and B tuning unit; C-variable condenser, 0005 m/d. (23plater; D-crystal detector; Efixed condenser, 0005 mld ; P--

wooden panel for variable condenser; Gwooden basehoard, \$ by 11 inches; four binding posts, dial for variable condenser, acrews, etc.

You will have to huy about a quarterpound of No. 22 double silk-covered wire for the tuning unit A-B, and of course you also will have to purchase the variable condensor C, the crystal detector D, the fixed condenser E, and the binding posts and dial for the condenser.

It is a mighty good idea to buy a really good variable condenser and dial, because these parts can be used later in a vacuum-tube receiver. Get a dial of standard make so that you will have no difficulty in matching it if the vacuumtube design calls for more than one dial

'HE rest of the parts can be of lowpriced type and of course the baseboard and the panel for the variable condenser can be cut out of an old packing-case or any stray half-inch board that happens to be handy

The tuning unit A-B is wound on a piece of cardboard tubing two inches in outside diameter and four inches long. There is no magic in this particular size, however. You can use smaller or larger tubing if it happens to be convenient, although you will have to change the number of turns of wire to correspond. The larger the tubing, the lower the number of turns of wire needed. Cottoncovered wire or enameled wire can be used if you prefer. Use more turns with

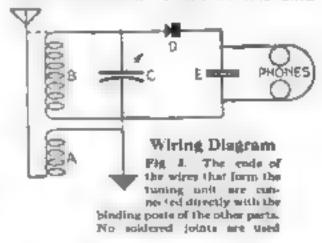
PHONES GRD ANT

Pictorial Wiring Diagram for Beginners Fig. 2. Dotted lines indicate connections when very short automa is used or when broadcasting station is for away

1 n-covered and fewer with enameled wire. 4 A consists of 30 turns of wire and coil B has 35 turns. The number of turns in coil B is emined by the variable condenser you use. a number of turns in coil A on the other hand,

should be adjusted so that you will get the proper degree of sensitiveness and selectivity, and these factors are in turn governed by the dutance from the broadrasting station and the size of your antenna.

Two small holes are punched through the cardboard tuling at the point where each coil begins and ends. The coils are wound as close together as convenient. The end of the wire is passed in one hole and out the other, leaving a long end that can be connected directly with the other instruments. The completed coll is held in place by a small brass right-angle bracket in the model receiver, but it is equally saturactory to glue the end of it to the baseboard. Don't do this until



you are sure that you have the windings right for your particular conditions.

IF YOU are very close to several broad-casting stations and you can put up a long outdoor antenna, you may have to cut down the number of turns in coll A. I would suggest that you wind the specified number and then take off turns until you can separate the different broadcasting stations.

Perhapa you are as much as five miles away from the nearest station. In that case you should increase the number of turns in coil A, or you can decrease the number of turns in coil B and connect binding posts Nos. I and 2 directly with the ends of coil B, thus elimmating coil A altogether. How to do this is shown in dutted lines in

The reason for decreasing the number of turns in coil B when coil A is chiminated in because in the latter case the antenna and ground become part of the tuned circuit and their capacity is added to that of the variable condenser C Eliminating coil A also is desirable if you have to use a short antenna of, say, 40 feet or less. You cannot expect to get good reception with any crystal set, however, on such a short antenna unless you are within a mile of the broadcasting station.

I AM giving these possible variations so that you can adapt the crystal set to your own particular needs. If you are in doubt about how to do it in your own case, I shall be glad to advise you if you will let me know the actual distance to the nearest broadcasting station and the length and height of antenna you can put up.

After the coil A-B is wound, study Figs. 1 and 4 and mount the rest of the instruments as

DOWN.

The wiring is extremely simple. The wire from the upper end of coil A goes to binding post No. 2 and the other wire from coil A goes to binding post No. 1. Then acrape off the insulation on the wire from the lower end of coil B so that you can connect it with the binding post that is on the metal framework of the variable condenser C. This wire continues to one side of the fixed condenser E and then to binding post No. 3.

New connect the top end of cell B with the binding post on condensor C, which is fastened to the stationary pistes of the condensor Many types of variable condensors have a binding post at each end of the stationary pistes. If yours is of this type, connect the other binding post on the stationary plates with one terminal of the crystal-

detector stand.

COMPLETE the wiring by connecting a wire from the other terminal of the crystal detector stand with the remaining terminal of fixed condenser E and continue it to binding post No. 4

The antenna should be as long and as high as you can get it and should be insulated at every point where it touches any support. Connect it with binding post No. 1. Then connect binding post No. 2 with the nearest cold-

water pipe.

The head phones should be connected with binding posts Nos. 3 and 4. Buy good head phones. The quality of your reception depends on them and they al-

ways will be useful, even with a vacuum-tube set, for tuning in distant stations and for listening in late at night when you do not want to disturb the neighbors by running the loudspeaker.

Most head phones are adjusted so that they will clamp tightly on the smallest size of head.

\$225 in PRIZES

Remarkable Contest for Radio-Set Builders

WATCH for the December number of Popular Science Monthly. It will give you all the rules for a new and decidedly unique radio competition.

It will show you how you can build yourself a fine radio receiver and at the same time compete for a first prize of \$150, a second prize of \$50, and a third prize of \$25.

You need not be a radio expert to stand a chance of winning one of these prizes. And even if you do not win a prize, you are sure to have a highly efficient radio receiver as compensation for your trouble.

This contest will give you a chance to exercise your mechanical ingenuity, your skill as a home craftsman, and actually to do intensely interesting and practical experimental work in developing an excellent radio receiver.

Don't miss this unusual contest IN NEXT MONTH'S ISSUE

You will find much more comfort in wearing them if you will bend the frames very carefully until they will just stay in place on your ears. Additional comfort may be secured by bending the headbands so that they touch your head evenly for several inches instead of just at one or two spots.

To get the set into operation after everything is connected properly, check up the radio program in your daily paper and make sure that the station you want to hear actually is broadcasting. Place the head phones on your head and with one hand turn the dial of condenser C back

and forth very slowly, while with the other hand lightly touch the fine wire, called the "catwhiaker," to the surface of the crystal at various points. Eventually you will find a sensitive spot and you will hear music or speech in the head phones.

JUST as soon an you hear the faintest cound in the head phones, stop adjusting the crystal detector and turn the dial of condenser C until the signal is as loud as possible. Then let the dial alone while you readjust the cat whisker until the music or speech is as loud as possible. The next step is to write down on a piece of paper the number on the dial at which the signal is being received.

The crystal will stay in adjustment for as much as several days at a time if it is not accidentally jarred out of position. It is well, therefore, to locate the receiver where you are not likely to strike it with your arm in moving about the room, and it also is worth while to set the whole outfit on a soft pad of cloth to take up vibrations that may be transmitted to it from the table.

You will find there is a great difference in the sensitiveness of different grys-

tale. Some are very much better than others. As a general rule, the fixed type of crystal detector is not so sensitive as those in which an adjustment can be made to find the extremely sensitive points.

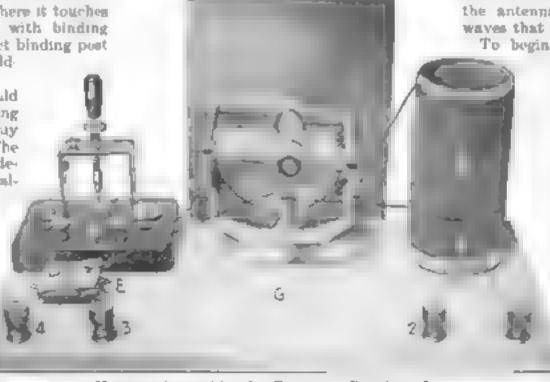
WHEN you finally locate a really sensitive crystal, it should be treated carefully. Protect it from dust and do not handle it with your bare hands. Use pilers to pick it up or use a piece of dry cloth over your fingers.

Since this crystal radio receiver will be your first introduction to radio at first hand, you probably will be a bit curious as to how the radio signals that come down the antenna are converted into sound waves that you actually can hear

To begin with, the radio waves are cacillating back and forth at enormously high frequencies. At a wave length of 200 meters they are sliding up and down your antenna and through the A coil of your receiver at a rate of 1,500,000 times a second. This current, moving back and forth through the wire in the A coil, sets up a rapidly changing magnetic field about the coil and the changing lines of force cut through the turns of

wire in the B coil and induce a current in them. This current in turn flows back and forth through the wires of coil B to the plates of variable condenser C

Turning the dial



How to Assemble the Parts on Baseboard

Fig. 6. This view shows how to assemble the instruments on the baseboard and wonden panel. Note that the connections from banding posts to the fixed condenser 5 are made by meson of 6-31 brane screws passed through the bolos as each cyclet as illustrated

The Popular Science Institute of Standards Tells

When a Radio Coil Is "Low Loss"

VERY radio fan who buys or builds a radio receiver is interested vitally in the tuning coils used in the set, for the efficiency of these parts determines, to a very large extent, the selectivity and dutance-getting ability of the outfit

All sorts of tuning coils have been recommended by various radio engineers and experimenters. One authority maintains that the spider-web type of winding is the hest. Another is equally sure that a plain, cylindrical coil has more advantages. And so it goes, with new types of coils appearing on the market, each one claiming to be a marked advance over its

Sometimes the new con actually is better. This is usually the case when the design is the result of intensive research work by competent engineers. But unfortunately, there are many colla that are produced solely to catch the eye of the radio-set builder.

predecessors.

Then, too, the sharp tuning qualities of a radio coll are influenced to a great extent by the other parts in the receiver This means that a coll that

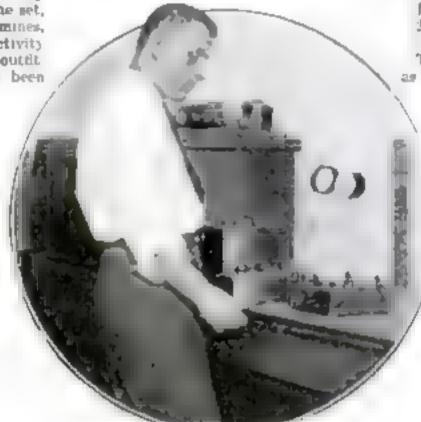
shows up well on the test bench may not give as good results when built into a receiver because the other instruments in the set may be mounted in the wrong position with relation to the magnetic field of the coil.

The characteristics found in every tuning coil and that determine its efficiency are:

 Its inherent resutance or the actual resistance of the winding to the passage of radio-frequency currents.

2. Its distributed capacity, or the electrical capacity of the turns of wire, one with another, which permits the current to flow across the coil instead of

By Alexander Senauke, M.E., E.E.



Testing Colls at the Institute
Note that the colls are assurated to midels by means of strings.

This is in order to elemenate the effect of stray magnetic field

through the wire. This effect runs up the apparent resistance of the coil and reduces the wave-length range that can be covered with any given variable condenser.

3. Its stray magnetic field, which also increases the apparent resistance by permitting energy to be lost through the generation of waste current in the metallic part of neighboring apparatus. This property of tuning coils is highly important, for it is the cause of feed-back and howling and often causes a coil to show up very poorly when it is used in a radio receiver

Bearing those facts in mind, we can say

safely that a tuning coil for use in modern radio receivers should have

Low resistance.

Low distributed capacity
 A concentrated magnetic field

The effective radio-frequency resistance as measured in the Popular Science

Institute of Standards Radio Laboratory, includes the sum of the first two causes of collinefficiency, but does not take into account the stray magnetic field, because laboratory measurements always are made with the coil well asparated from any object that might influence its action

The radio-frequency resistance of a coil depends, also, on the diameter of the coil and the number of turns of wire in it. This means that a coil designed to cover the broadcast range of wave lengths when used with a .0005-microfarad variable condenser (28-plate), naturally will have a lower resistance than another coil of the same type that has sufficient wire to cover the broadcasting range with a smaller condenser.

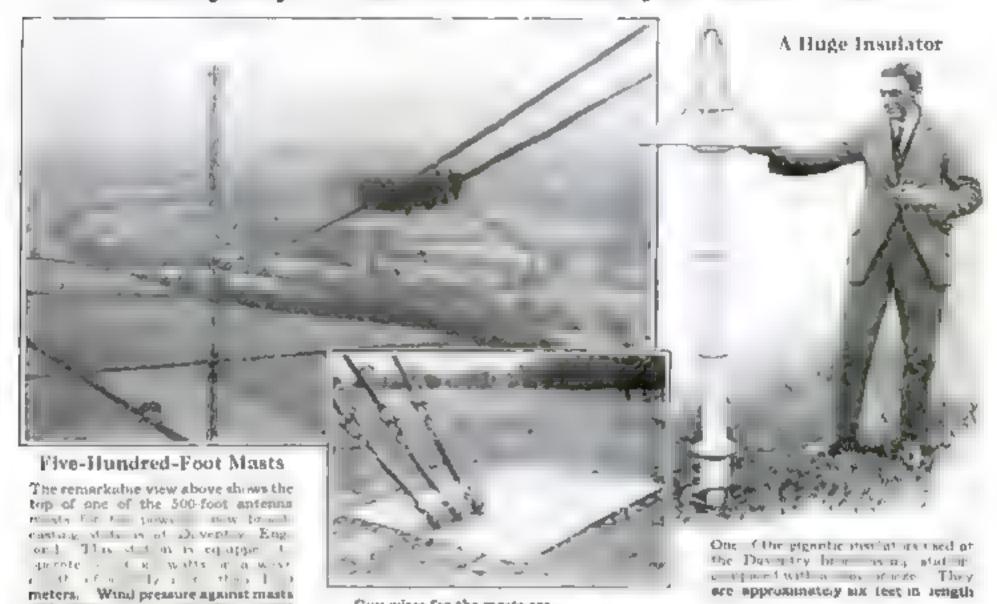
The inductance of a tuning cell is measured in microhenries and the efective resistance is measured in almos. In our test work we use a figure of merit that allows us to compare cells of different sizes. This figure of merit is the ohms resistance to each microhenry of inductance.

The accompanying table shows some of the results of tests on various types of tuning soils now obtainable in the open market. These tests show only the effective resistance of the coil when supported in the air at some distance from any other instruments. The figures indicate, therefore, the relative value of the coils only when they are used in large radio sets.

No.	Description and eyes of gooding	th en.	Louph	Wire ar and Excellence	fuductioner in m. rob uses	Rel classes at bill Meleys	Res stance at 4000 Me for	Re wone	Alexander R. F. Reservance	Rent of Alex Rentinger per Marchaeles
1	Single-layer soli frond in high	J b.	J.G. n	No. 11 de c	144	5 (1	10	5.4	4.8	077
1	Same	3 40.	1 % nc	No. 22 dag	133	6.4	3.2	4.3	3.3	0,15
3	Single-inverses not supported on bakette frame with deposit	3-0.	235 es. 1	No. 22 data.	246	7.6	17	4.3	3.9	,024
4	Single-later extension stag- go or adjactors to us, with bill stip composed to at consumpt to supportions	3 to.	7 *0	No. 22 date	284	6.9	7 0	5.4	7 L	.015
3	Nipste at r solehole spaces half fam, of wire on cellu-	3 in	1, :1	% 2Z +35.6	2.6	7.6		4.3	S II.	-021
0	Minute is the lemm in skele- tro hard-runbert he	← į in.	b 151	5-10-1-6	1 144 1	7	5.6	4.2	5.7	031
7	Must dater hope only on	2.9 4.00	971	5 4460	1'0	4.5 M	t .	1,1 4	'0 0	08,5
٠	Pancake, self-supporting, on three wooden pegs	Inque 114 in. Putate 3 a n]	70×, 24 (cm)	340	21.0	18 4	130	17 5	IJ 32
ņ	Drabbe-coil emerges wind na- spaced on celsuloid film	l?₄ n. each	t light of the	No. 30 sax	295	16.1	15 8) ' 3	15.8	055
10	Complete toroid staggered ad- jureat turns, model skele- tur supporting frame	Orrade 4% and Indde 1 and		No. 27 dec	180	11 6	9.6	a a (9.9	.055
11	Lorenz banket, mit-appporting	4 in.	1-56 in.	No. 10 date.	10.2	6.0	4.5	3.4	4.6	025

Some New Marvels of Radio

How Mystery Waves Are Harnessed for Greater Uses



Guy wires for the masta are fastened to a constant and to a constant anchors weighing 60 tons

Glant Tubes for Station WPL

and antenny is an great that special

er a dayar so in in in it is a

uhnit specs con a district State Sta

Ber w. I an excellent view of the transporting tuber now being used by Stotion WPL of New York City and other brondcasting stations scenared to transmit on high power. The tubes are water cooled, since otherwise the intense heat they give out would destroy the elements

Radio Car Will Cross Continent

A New York sate

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Apparatus that controls driverless cor

Breaking in Your New Set

How to Install It for the Best Possible Radio Efficiency

PERKINS, who lives that the dropped in a few registration and asked me to the registration to his house for a minute."

I noticed that the living-room was lighted more brilliantly than usual and the reason for the bright light and the call for help was quite apparent as we stepped into the room.

In the middle of the dire was a huge cardboard packing-case with the name of a prominent radio manufacturer printed in large letters on the side. Surrounding it were amaller packages. Evidently my friend had decided to become a radio fan, and while he was about it had purchased a complete outfit Aside from the radio receiver itself, there were a storage battery, several blocks of dry-cell B batteries, a

loudspeaker, antenna equipment, and a lightning arrester, also several krife switches and a cell of wire for making connections.

"NOW that I've hought it." said Perkins belp-lessly, "I can't for the life of me figure out where to put it all. The wife will have a fit if I muse up the flying-room with a lot of unsightly wires and things. What'll I do?"

Thousands of men have stood in Perkins' shoes; for there is no question that the proper installation of a radio receiver often presents a real problem. Frequently a compromise has to be made between efficiency, appearance, and ease of

operation to keep peace in the family.

As for Perkins' set, we finally decided to put the receiver on a table in the living-room, run wires through a hole in the floor to the batteries in the cellar, and place the loudspeaker on a bookcase many by

If you are living in an apartment, where everything must be kept on the same floor, you cannot put the batteries in the cellar. A good way to do in such a case is to purchase or construct a radio-cabinet stand that includes a compart-

By John Carr



A to column stand with

to still the terries

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The process of the wag-room

In this cellur installation, the A batteries light the filuments of the receiver and ring the descrbell. Wires smarked A above the battery runto the receiver and those marked B to the bell

ment for the batteries. Another way is to hide the batteries behind some near-by piece of furniture or in a closet.

Aside from appearance and the necessity for locating the receiver near the best place to connect with the lead-in wire, the question of light is important. You must place the receiver where the lights Useful Hints that Will Help to Solve Beginners' Problems

already in the room will share on the tuning duals; or else install a special drop-aght near the set.

Fortunately, the loudspeaker can be installed wherever you want it without regard to the position of the receiver itself. This is hecuse the volume and tone are not unfected by the length of wire between set and loudspeaker. It is possible, therefore, to locate the receiver in the cellar, attle, or atches and still enjoy broadcasting in the living-room. The only disadvantage of such an installation is the inconvenience of retuning if you decide to listen to the program from another station rather than the one for which the receiver is adjusted.

THERE is one real advantage in placing the loudspeaker some distance from the radio receiver. Such an arrangement positively prevents any chance for howling and humming notices, which sometimes are produced by actual mechanical vibrations set up in the eloments of the tables by the waves of sound from a loudspeaker that is too near by

The location for the receiver decided upon, the next step is the erect on of a suitable outdoor an-

tenns. Of course, theoretically, there are perfect methods for erecting an antenna, but the average radio fan is so bound about by the physical limitations of the location, that his antenna probably is far from perfect anyway.

YOU can be satisfied that you have the best antenna possible if you get it as high as possible and as long as you can up to 100 feet. This does not mean that you should erect a 50-

foot pole. It is sufficient to fasten the far and of the antenna to the highest natural support available. The chimney of your neighbor's house, the water tank on the top of the apartment house, or similar natural high points usually are suitable. As far as insulation is concerned, all you need remember is that no part of the antenna or the wire that leads down from it to the receiver should touch anything but insulating material until it reaches the binding post. In-

(Contenned on page 1-9)

New Auto Equipment

These Ingenious Accessories Will Add to the Car-Owner's Enjoyment



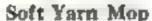
This little rubber circle with its amber glam center (below) will shield your eyes from the sun or the banding glare of a headlight at night. It is





Motoriat's Khaki Cover-All

This garment can be put on like a coal. It buttons up in front and the lega are fastened by clasps. It is made of a khaki material that will fold up casily and go in the toolbox, or it can be worn when driving over dusty, sandy, or muddy roads



Fitting on the end of any hose, this auto mop, made of absorbent yarn, is said to be absolutely harmless to the finest enemel finish. It will not accatch, because of its soft texture and because it is asturated from the sides, flushing dirt and got in its path

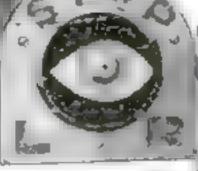


New Rim Tool Will Fit Toolbox

By means of the setscrews in the jaws of this rim tool, a tire rim is held with a firm grap. One movement contracts the rim and holds it in position until the tire is replaced. The tool will fit easily into the auto toolbox



The manufacturers of the in geniously simple heater shown above claim that just a pape to cut a notch to make, and three small holes to drid" is the only work required to install it in any motor-car. It runs parallel with the steering red and is fed from the engine exhaust pape. The illustration shows how temperature is regulated by an adjustment lever controlling a valve



The "Flirt"

It may be an amusing stop agnal, but it is almost sure to attract the uttention of the driver behind. When the car is stopping the eye rolls in the direction the driver is intending to turn. At right it is illuminated, serving also as a tail-light



Grease Container

A tarvel and inexpensive greate container is made of staff cardboard. It is shown above being used to fill a greate gun. Turning the base of the tube ejects its contents. A small screw top keeps the contents airtight

Thermostatic Control

No more stalled engines dur to cold weather, say the makers of the thermostatic water control shown at the left, which keeps the engine at the most efficient running tranperature all year and requires no corburctor adjustment



When Foresight Saves a Crash

Gus and Joe Go Hunting and Dodge Foolhardy Drivers

"DOGGONE" exclaimed Gus Wilson, half owner and chief mechanic of the Model Garage, as he piloted his automobile to the rear of the line of care that was creeping along toward the railroad crossing. "No matter how early in the morning a fellow starts out, there's bound to be a bunch on the road aboad of him!"

Joe Clark, Gun's partner, the office man of the combination, settled himself a little more comfortably in the roomy front seat of Gua's ancient and honorable machine

"Huh!" he grunted with a sly grin.
"What do you expect on Election Day?
Of course there'd be people on the reads.
This isn't your private holiday."

"I know all about that," growled Gus
"But you'd think some of them would
learn how to drive before they come out
Look at that dumb-bell down the line
there. Wonder how he expects anybody
to get past him, crowding in that way?"

"He's probably like you in a hurry to go rabbit shooting," suggested for teamingly "The trouble with you hunting bugs as "

Joe got no further, for at that instant and apparently for no reason at all— Gus jammed on the brakes so suddenly and so forcibly that his partner was caught unawares and almost extapulted through the windshield.

"HEY!" he protested, as he tried to regain his balance. "What in blazes are you trying to do?"

Before Gus had time to reply, there came a piercing scream and a grinding crash, followed immediately by a series of prinor crashes as the care ahead of the two garagemen telescoped into each

By Martin Bunn

other like a lot of freight-cars when a powerful locomotive takes up the slack in a train

Gun's car had been only a few feet behind the car in front, but hy applying the brakes so suddenly. Gus had succeeded in dropping back a full 20 feet before the crash came, and now—with locked wheels—his car skidded to a halt without quite bumping the car ahead.

"Gosh!" panted Joe. "That was a close call. How did you know there was going to be a smash-up?"

"By keeping my tym open," replied Gus a bit groffly, as they joined the crowd of pale and nerve-shaken motorists THE motorist who had caused the amash-up was surrounded by the owners of the care that had piled up behind him, each one shouting angrily in an attempt to make himself beard above the hubbub.

who were standing about the damaged

cars at the front of the line. Miraculously

enough, nobody had been injured se-

riously, in spite of the quantities of broken

glass that bad been flung in every

direction

Just as the argument seemed about to turn into a free-for-all fight, a motorcycla policeman appeared.

"Speaking of dumb drivers," said Gus, after the officer had restored quiet and the cars were moving again; "you remember that bird who pulled up along the line while we were westing? Well, the road at the crossing is wide enough for three cars abreast, so the single file of cars coming the other way could get past. But when a fellow coming the other way tried to get out of line, that made four cars—and right then I slammed on the brakes. Our dumbbell friend tried to get back into line when he saw the other car coming. But there wasn't any space to push into because the rear car could not drop back quick enough. They crashed, and the drivers ahead were caught nopping "

"WHICH only goes to show," and Joe, "that the right time to pass a car is something lots of drivers don't know."

"Humph?" Gus grunted. "There's more to it than that. The drivers of the (Contented on page 159)

Like a Centipede

You have seen them—a bunch of heads stuck out all together and no two heads pointing in the same direction. "Let the driver do all the signaling," says Gos

How to Give Furniture a Beautiful Finish



The Juhanen Book gloss complete instructions for finishing new and refinishing gid wood saft or hard. This book is the work of experts to be multifully illustrated in color. Ask for a bree copy of your best painter hardware store.



Stores displaying the above sign carry a fail line of fahrson's Artestic Interior Fenishes. They will give you a free cupy of the Johnson 35c Book on Home Brautifying and are competent to unseer questions and give advice on the proper finishing of word. These stores will gladly show you pencis of word finished in many bountiful effects.

AFTER spending precious hours making furniture by hand you naturally want to give it a beautiful finish. And surely the finishing should receive its share of attention, for a beautiful piece of furniture may be ruined if improperly finished, whereas any small defects are minimized in a well-finished piece. So the finishing of your furniture becomes a matter of prime importance.

First apply a coat of Johnson's Wood Dye. With this you can color the wood any one of 17 beautiful shades. Johnson's Wood Dye is very easy to apply

-it dries in four hours and will not rub off or smudge. Penetrates deeply, bringing out the beauty of the grain without raising it.

Open grained woods (oak, chestnut, ash, mahogany, walnut, etc.,) should then be given a coat of Johnson's Paste Wood Filler followed by a light coat of Johnson's Under-Lac or pure white shellac. The furniture is then ready to be finished—either with two coats of Johnson's Prepared Wax or Johnson's Varnish. For close grained woods (pine, cypress, maple, birch, etc.), omit the Filler coat.

Follow these instructions for finishing furniture and you will be assured of perfect results—the thrill of pleasure when the work is new and yearly satisfaction at its wearing qualities.

S. C. JOHNSON & SON, "The Wood Finishing Authorities" RACINE, WIS.

JOHNSON'S WOOD DYE

Some New Ideas for the Motorist

Half a Dozen Ways to Save Money on Your Automobile

IN STEADY driving, the motorist's left foot is used only to work the clutch occasionally and this idle foot can be used very well to operate the windshield wiper by the arrangement shown in Fig. 1. Two ordinary hand-operated windshield wipers are clamped on the windshield with a conspring at the right attached to the arm of the right-hand wiper. Then a simple pedal is placed on the floorboard next to the clutch pedal. This pedal can be made of a small piece of wood hunged to the floorboard.

At the left end of the windshield a small pulley is festened and a cord run from the pedal through the pulley and to the left and then the right wiper arms. Pressing down on the pedal pulls both wipers to the left and the spring pulls

them back across the glass when the fact is lifted from the pedal.

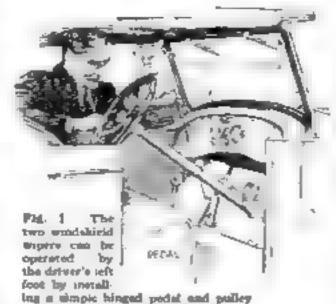
SOME auto-drivers are under the impression that a car can be driven home when the front apping breaks, elmply by blocking up the axle with a piece of wood. This is true if the long leaf that holds the spring-sbackle hushing remains intact; but if every leaf is broken, the flexihility of the shackle at the rear of the spring will allow the axle to move back under the car so far that steering will be difficult if not actually dangerous. As Fig. 2 shows, a clamp and an extra spring leaf used in conjunction with the wooden block will bring you home safely.

A TORN celluloid window plus a few rents in the material itself will make the back curtain of a car very unsightly. Of course, a simple remedy is to buy a new curtain, but some owners will prefer to do the work themselves.

Figure 3 shows how this was accomplished by an auto-owner who takes great pride in doing a nest job. After the new curtain material was tacked in place, he held the wooden frame in the position to be occupied by the rear light and cut the curtain material as shown in the upper part of the Bustration. The lower part shows the details of the frame that held the glass in place. If a celluloid window is to be used instead of glass, a good stunt is to cut the window the shape desired, sew a strip of material around the opening, and sew in the celluloid

with a bobbin and black tape. The holes in the celluloid should be punched with a paper punch. Then if the celluloid cracks or tears, a new window can be made in a few minutes.

THE most common cause of trouble with the gasoline supply system is clogged pipes, due to dirt or scale from the tank. Such trouble usually is found



ment the clutch pedal of your car

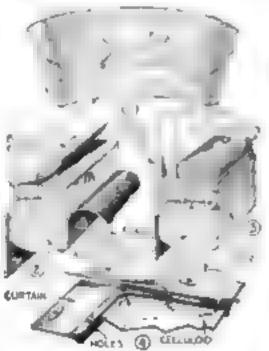
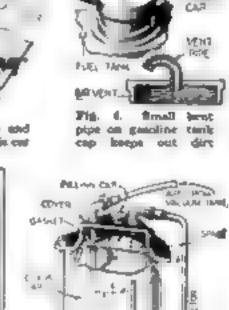


Fig. 3. How one man set up and made a new back murain for his cut



WOOD BACKING

erpair for a

spring.

front

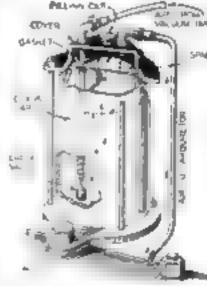


Fig. 5. This simple device for feeding water vapor into the cylinders to cut down carbon deposit works automatically

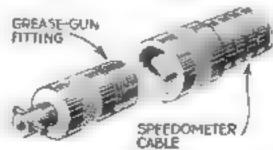


Fig. 6. An old grease-gun fitting screwed to speedometer cable shaft helps lubrication

easily enough, but a plugged vent hole in the gasoline-tank cap sometimes produces mystifying results, because the flow of gasoline is interrupted only partly. Air must be allowed to enter the main gasoline tank to take the place of the supply drawn into the vacuum tank by the suction of the manifold. The simplest way to protect the vent bole in the gasoline-tank cap is to solder a small piece of bent copper pipe over the opening, as shown in Fig. 4.

THE injection of air beavily laden with water waper into the manifold of a gasoline engine helps to keep down carbon deposits and, according to some motorists, actually gives the motor more power. In Fig. 5 is abown a simple way to make a device for feeding water vapor into the

cylinder at regular intervals, requiring no attention on the

part of the driver

The glass container is an old mason jar, held in place on a piece of heavy sheet metal bolted to the cylinder head. A defunct ammeter supplied the metal top. which is drilled for the two elbows and the filler cap. The pipe that goes from the vacuum tank to the manifold is cut, and the end of it, which is attached to the vacuum tank, is connected with the show that has a pipe extending into the solution. The other elbow is connected with the section of the pipe that goes to the carburetor or manifold. At the bottom of the pipe in the jar is placed a small cork float on the end of a pin.

Each time that air is drawn from the vacuum tank into the manifold to replenish the supply of gasoline in the vacuum tank, the air is made to bubble up through the water in the jer and becomes heavily laden with moisture. The check valve is used to prevent sudden pressure in the engine manifold from forcing water back into the vacuum tank.

Pigure 6 illustrates a simple way to force grease down around the flexible shaft inside the speedometer cable. An old grease-gun fitting was found in the scrap pile that could be acrewed into the coupling on the end of the shaft. A hole was drilled and tapped in the end of this fitting to take a pressure

дтеща пірріс.

It is a good idea to force light grease or heavy transmission oil into the speed-ometer cable at least once every 5000 miles and, while you are about it, check up on the meshing of the fiber gear that meshes with the larger metal gear attached to the front wheel. See that the fiber gear is in position, or it will will wear out in short order.

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so all could listen-in

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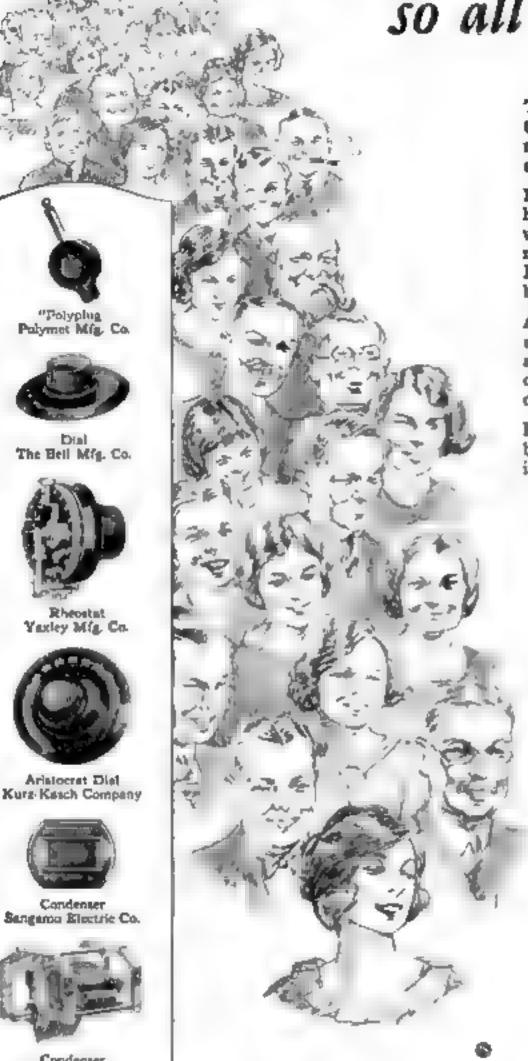
All of these properties and the beautiful color and finish of Bakelite are permanent-unaffected by time, use or climate. So "Radio drafted Bakelite," and today it is used by over 95% of radio set and parts manufacturers.

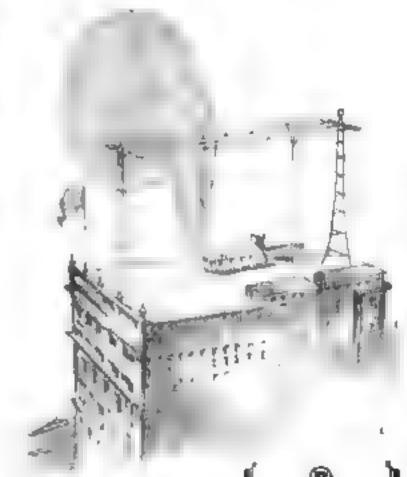
Make sure that the radio set or parts that you buy are Bakehte insulated, for good insulation is essential to clear reception.

Write for Booklet 25

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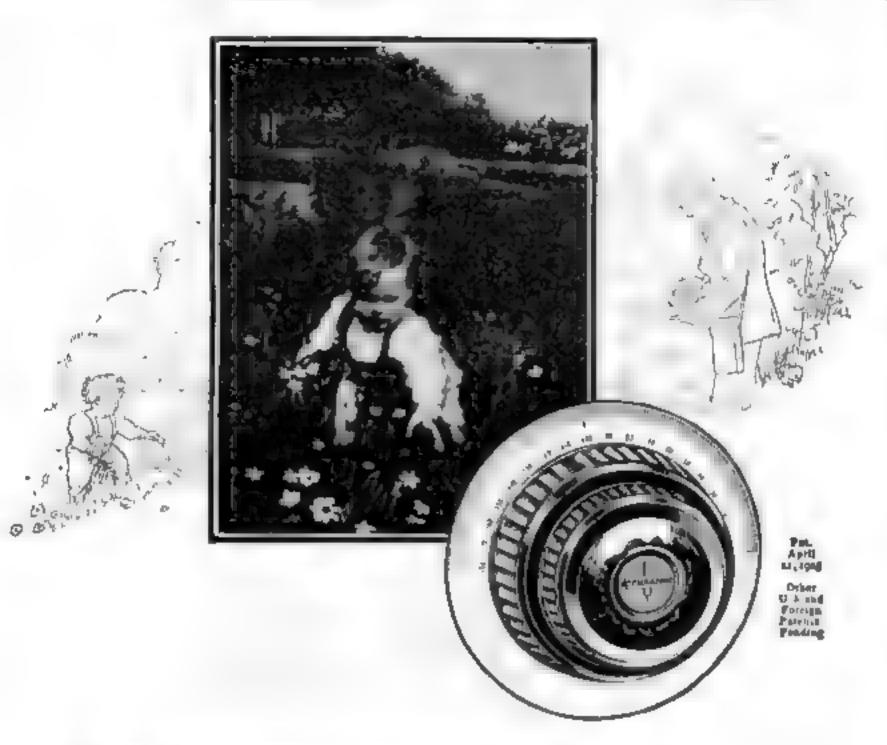




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THOUSAND MATERIAL \mathbf{OF}



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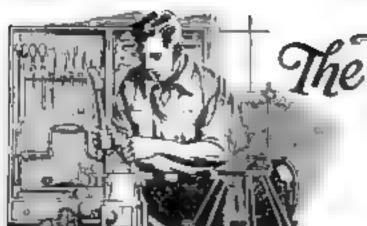


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Home Workshop

Arthur Wakeling, Editor

How to Fit and Hang Storm Sash

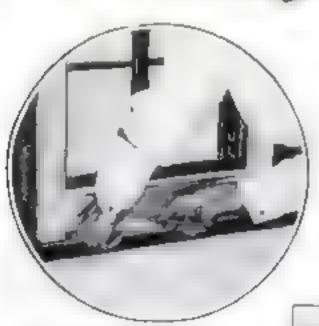


Mr Tustison is Director of Science and Home Machanics at the Stout Institute, Manomonie, Wu.



Test such edge by holding the seeb in the frame. Much try high spots and plane them off. Sevel and allow 1/10 ps. clearance

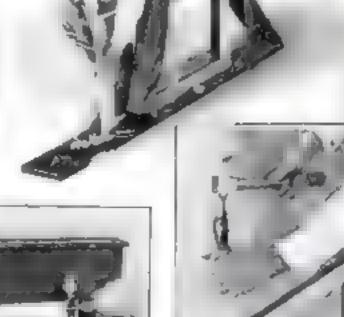




When the elder At properly stand the seah in the frame and mark the bottom by sliding a block slope the still. Then mark the bevel with the same black

ROPERLY installed storm such are a splendid insulation against wintry blasts. They make it possible to keep a house at a comfortable temperature with less coal. Indeed, the saving in coal, which is now a matter of the most pressing importance to every householder, quickly pays for the double windows.

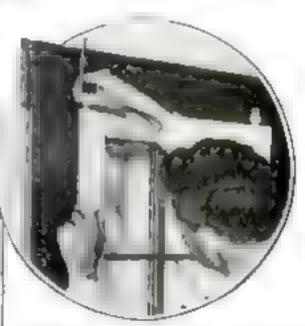
Usually the extra sash need be applied only on the colder and most exposed sides of the house. The first step is to measure each window frame in the acreen rabbet, which is the recess provided at the outside of the frame ex-



Planing the bottota bevel balow)

Fastening one of the hanging eyes to the such, and the simplest way of numbering the such by theseling Roman sumerals on edge

pressly to take storm such and outside window screens. Incidentally, the steps to be followed in fitting storm man are precisely the same as those required in hanging outside acreems, and the same hangers purve for both. Prepare a list



Mark the top for length after the side end bottom have been fitted and saw off the waste afterward smoothing down the edge by planting if it is found necessary

of the sizes and order the seek from a lumber dealer or mill

Before attempting to fit a sash in a frame, it is well to check the size of the frame and seah. If a number of the windows are the

same size, two sticks can be cut, one giving the exact length and beveled at the bottom to suit the slant of the

(Continued on page 1/2)

THIS month's Home Workshop will be found on pages 69, 70, and 74 to 124. The Better Shop Methods Department on pages 72 and 125 to 136, and The Shipshape Home, on pages 138, 139,

Chair in the Simplified Spanish Style

A Fine Example of a Type of Furniture Now Very Popular-Its Unique Construction Makes It Unusually Easy for the Amateur to Build

NURNITURE of the so-called Spanish datyle, which recently has become so tiopular, holds many fascinating possibilities for the amateur woodworker Many of the pieces can be simplified to a degree not possible with furniture of other periods and types, yet they are rich, dignified, and exceedingly deco-

rative in appearance.

A striking example of this style of furniture is the chair illustrated. The design is an adaptation of a genuine Spanish chair of great value. The details have been simplified to the last degree by George F Kaercher, the designer. Practically all the usual difficulties in chair-making have been avoided, Indeed, a chair hardly can be made with simpler joints of fewer angles; In these respects the construction is even easier to follow than the now practically obsolete Mission furniture.

Furthermore, no skill in upholatery is needed, because the back and seat, following the style of the original chair, are simply pieces of Spanish leather featuned to the rails with large brass

upholatery natia.

A piece such as this deserves to be made of a fine cabinet wood, and the wood must he hard and strong to insure durability. Oak and walnut are especially suitable.

Instead of the usual mortises and tenons, dowels are used throughout in the

joints. Great strength is added to the construction, however, by the addition of four bed-screws or bolts, which reinforce the joints between the legs and the front and back stretchers. Each stretcher also has two dowels at each end to keep it from twisting. Slots are cut into the stretchers from the inside faces to allow the insertion of the bed-screw nuts, The 1-in, holes in the sides of the less to take the heads of the bod-screws are plugged with wood afterward.

To obtain the carved effect on the front stretcher, a piece of wood 14 in. thick is laid out with the design shown in detail below. The waste wood is removed by boring holes and cutting on the lines with a fretsaw. The panel then is glued to the front stretcher. If desired, a few of the smaller fretsawed ppenings can be pierced right through the stretcher itself. It will be noted that there is only one rail connecting the back legs above the seat level and that is at the upper edge of the leather back.

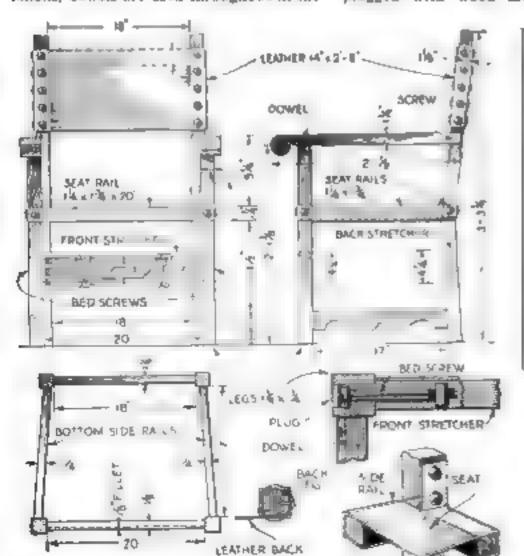
The leather, which must be of a first class quality and free from imperfections, abould be large enough so that the edges can be turned around the legs and rails and nailed very securely. The edges of

the rails that are to come in contact with

the leather should be rounded

It is advisable to make a pattern of beavy paper and after it has been cut to fit perfectly, use it as a guide in laying out the leather. It should be noted that the leather is fitted around the less by making shits: none is removed, as the flaps are made use of and fastened to the legs with uphalatery nails, as shown.

It is possible and in some ways desirable to omit the front seat rail entirely. The seat is a trifle more comfortable without thus rail, but the strain on the leather is greater, so that heavy hide must be used.



Front and side views, plan of sent frame, details of had-screw fastening for stretchers, and method of attaching the leather

BACK RAIL

Bill of Materials for Spanish Chair

Front legs. 1% by 1% by 1134 in., 3 required Back legs 134 by 5 by 1956 in., I required to cut 2 legs Front stretcher 25, by 426 by 20 in. I required by 454 by 10 in. I required Back seat rail doweled) 1% by 12, by 18 in. I red red Side seal talls (downered) 14, by Side housement is the world the by the by 17 in 2 are used from seat that the used to by Zarra ted The op 70 of the uned to by the op 70 of the uned to by 10 of the uned to by 10 of the uned to the by 10 of the to the uned to the total and where does not back? It by 24 by 74% of 1 required to by 74% of 1 required to by 74% by 74% of 1 required to by 74% by 74% by 74% in 2 required

Bed-screws (square or screw hears) 1/10 in. in connecter, 6 in long 6 required.

Overlay or filet for front mill against by 19 414 by 20 in, I required.

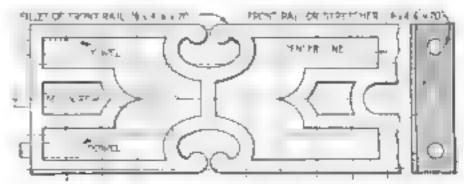
Oval-head brass uphotstery nails, 1 in. in d ameter 1 in, long, 60 reported. ferriger 05 Leather for sent Spanish hide, Learner for back Span sh hide.

14 by 52 pm 1 required

Downly manie. 1,16 m in
discheter 72 m, mag, 40 Tacks & or 1 package. Page for sed server soles, 1 at. 4 In. thick n diamete. 1 required ward to be used, prof-Hard eratile cak

Stain filler shellar and walk

wa. nut



View showing one half the thin fretwaved piece that is applied to the front stretcher. The light goods lines represent I in aquares

Home-Study Business Training

Does It Pay?



The Electric Auto-Lite Company, Tolado

C. O. MINICER, Pres. Electric Auto-Lite Company

SEXTEEN exembers of the pany are enrolled for home-study training with La-lians Extension University, LaSalle-trained men and women-in positions of re-sponsibility—are to be found to every large business organ-tection to America.

"It Increased My Income Approximately 700 Per Cent"

-So writes F. H. Landwehr, Secretary of the Electric Auto-Lite Company, Toledo



F. H. LANDWEHR, Sec'v Electric Auto-Lite Company

"We want men who can think beyond their jobs"

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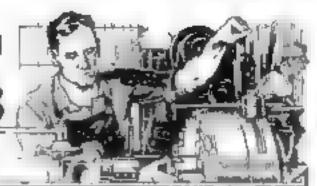
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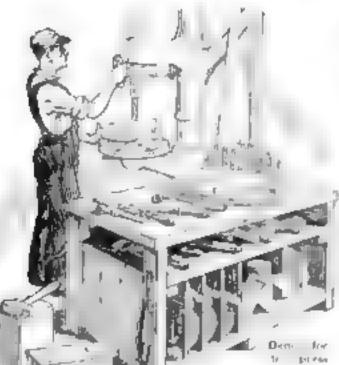
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Higher Accompancy: Training for posi- tion as Anditor Comptrainer Contilled Public Accompancy, Cod. Accompancy, etc. Expert Bookkeeplog: Training for posi- tion at Bead Bookkeeplog: Training for posi- tion at Bead Bookkeeplog:	Export, Preight Solicitor, one Railway Station Management: Training for position of Europe Accountant. Contier and Agent, Division Agent, ote. Stanting and Pinesco: Training for a security a positions in Banks and	Personnel and Employment Man- agement Training in the position of Personnel Manager Industrial Rela- tions Manager, Employment Manager,	Counterrain Spunish: Training for position as Foreign Correspondent with Spunish spunking countries. Effective Speaking: Training is the art of forceful, effective speech, for

Better Shop Methods

How Expert Mechanics Save Jime and Labor



Racks and Tables for the Shop



By Henry S. Laraby

"WASN"T the big boss peeved this morning, when he found that the die for that new customer couldn't be delivered?" Jim Balley remarked with his tantalizing grin, looking at Joe Black, who sat on an empty carbide can behind the shop, making away with his lunch

B)nck scowled at his termenter. The other machinists looked on in assumement, they relished the idea of an argument for the 15 minutes that remained of the lunch hour

"Of course he was mad!" Black retorted. "But it was not all my fault. What can he expect when I have to hunt half an hour for a piece of half-inch steel, and then have to plane down a piece

from three-quarter stock; and on top of that, when I went to grind it, there was no whoel of the proper grade. With all those things against me, I think I did very well."

"A very good excuse, but as they told me when I was in the army, it is results, and not excuses that are wanted."

A third man entered the discussion. He was of the type who seem always to merit the title "Mister." Older than the others, he was recognized by all in the shop, the How to Keep Lathe, Drill Press, and Planer Tools and Accessories in Shipshape Order

foreman included, as being a master workman.

"The shop and its owner have a lot on their shoulders," Mr Jackson said; "but, after all, the company is known by the men it keeps, and it is up to all of us here to help matters along."

"That would not put a piece of half such steel in the rack," Black stated with emphasia.

"No, it would not put the steel there, but it would have the bolts and clamps in the places where they are used, and not hidden away in Bailey's drawer."

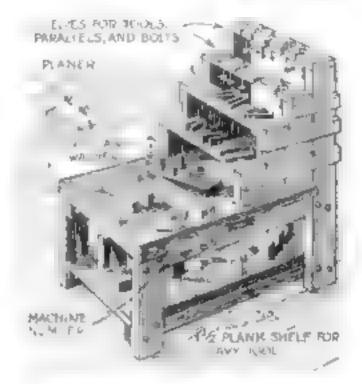
Balley winced at the thrust

"Now over by the planer is a heavy bench. It has several shelves, some of them with holes and slots in them for bolts, but there are no bolts there. The clamps are gone too. In the shop to blame for all of that?"

"I guess not," Black replied. "I remember when I first came here that every one seemed to keep things where they belonged."

"And another thing," Mr. Jackson continued, "I am sure that you lost an hour and a balf in boring the holes in that die because you could not find a drill chuck that would fit the tailstock apindle of the lathe you were using You finally had to take out your job and true up the center, which some one had broken off and left."

"That reminds mu," Bailey said, "of the way they used to keep the tools



A heavily built and conveniently erranged table for planer tools, straps, parallels, bolts, and note

together in a shop where I once worked. At the back of every lathe there was a board, with places for everything that belonged to that lathe. If you used that lathe end did not put everything back on the board, one of the toolmakers would be sure to ask you why you had not, before the foreman had a chance to find out about it."

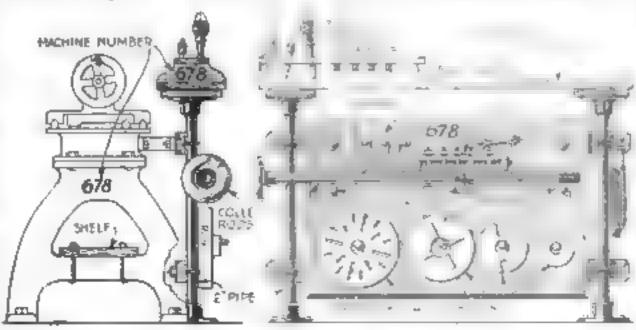
The shop's foremen stood in the doorway smoking his pipe. He appeared to be an interested listener

"I suppose you boys are raking me over the coals, too," he said. "I told the

boss about not having the proper size steel, and not having sufficient grinding wheels, and he has promised to get them. That is one result of this occurence. But there are a lot of things we can do ourselves to make it easier to get out the work.

(Consent on page 134)

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which is on pages 125 to 136.

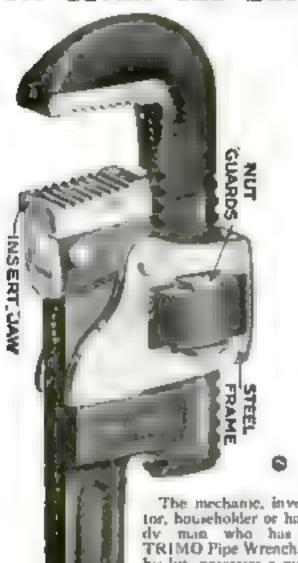


Lathe tool rack of word supported by pape standards. There are places for the faceplates and chacks, cultur rods and collets, straps, bolts, and other accessories



TRIMO

The Master Tool for Home and Shop



The mechanic, inventor, bouseholder or handy man who has a TRIMO Pipe Wrench in hи kit, роменев в піавter tool of a thousand and one uses.

While the TRIMO costs a few cents more than ordinary wrenches, consider how much more TRIMO offers your (1) an INSERT JAW in the handle which can be replaced for a few cents when worn out; (2) staccal NUT GUARDS that keep the wreach in perfect adjustment in close quarters or when you lay the tool down, (3) an extra-strong STEEL FRAME that WILL NOT BREAKyour guarantee of safety Endorsed by Popular become Institute of Standards.

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ROXBURY, MASS. America's Leading Wrench Mahers for Nutrly Forty Yours.

Me Kone Workshop

How to Make Best Use of Glue in Your Home Workshop

By Ernest F. Spencer

Wrighing both the dry glue and the water

is necessary to lastre the best results

NOT much in the way of woodwork or house repairs can be done without the aid of flus. For that reason the Editor asked Ernest P Spencer, an authority on glue and the head of the technical service of one of the largest glue manufacturers, to prepare an article telling the best ways to use glue in the home workshop. He responded with the following article, which gives in brief prectically all the information you need to know about glue.

AVE you ever had the pleasure of a httle workshop in your own home? It may be down in the corner of the basement or tucked away up in the attic, or even in the kitchen. Wherever it is, many beautiful and useful things can be produced in it for your own use or for gifts for yourfriends.

in building and repairing, glues play such an important part that we should know more about these sticky substances and how to use them so that the articles made or mended with their and will hold together under all reasonable conditions of every-day use

Glue has been used for many centuries. Back in the days of the Egyptian pharachs it was used to build beautiful veneered work. Through the centuries its uses have been multiplied.

Like the earliest glues, the bulk of those made today are from acraps of the hides, the fleshings, and the bones of animals. They are sold in ground, flake, and sheet forms.

Liquid glue usually is made from fish stock, which is washed and cooked in a similar way to animal stock. A very interesting characteristic of glue made from fish stock is that the gelatine or extracted glue does not jell, but remains in a fluid state at ordinary temperatures.

Cheap liquid glue should be avoided, because it gathers moisture. It contains quantities of salts, such as sodium chloride or common table salt. These salts absorb



Hat glue always should be applied freely to both edges of wood to be joined



A dairy thermometer to used to avoid accident ally beating animal glue beyond 150° F

moisture (ust as salt on the table will do and on a wet or humid day the glued materiam are not to full apart.

Good liquid glua has many advantages over other adheatves for use in the hame workshop.

It is purchased ready for use, so no weighing, seeking, or heating is required. On account of its slow setting quality, the workman is given ample time to get the joints properly together, whereas with het give the work must be done quickly before the glue sets or jells. Slow setting also means good penetration of the glue into the wood and added strength. When strength is compared, good liquid give is as strong as good animal give.

During the war, glues made from casein were developed rapidly. Caseln glues come in dry powder form and are prepared simply by sturring into cold water. They make a strong, moisture-resisting ount. For glued work exposed to outside weather conditions they have no superior. They are used universally in building airplanes.

There are other so-casied glues made from starches, dextrines, and blood albumen, which are used commercially for many purposes.

To obtain the best results with glue in the home workshop, we must have certain equipment. This should include a can of the best quality liquid glue, some high grade cabinet flake give, a jacketed givepot, two glue brushes, a cheap dairy thermometer, clamps, and hand screws.

Glue-pots can be purchased at any hardware store at prices from \$1 to \$2, according to size. The outer vessel is

(Continued on page 113)



Satisfies Every Owner—

IN radio, when one selection does not please, you simply tune it out and pick up another broadcasting station. If it is a matter of unsatisfactory volume or tone in your instrument then it becomes an entirely different matter.

You have certain very definite ideas in mind as to what you want your radio to do. Will you allow us to make a few suggestions regarding a plan whereby you can settle the radio question?

Select the instruments which you think might answer. Have a demonstrating instrument brought to your home. Let each salesman, in turn, make the necessary battery connections. Let him tell you how to operate it but do all the tuning yourself

You'll buy the instrument then, based on your own operation, You'll size up each one for

- -sase of tuning
- -dutance received
- -volume
- -tone
- selectivity
- -price.

There still remains one very important question to settle—the matter of service. No matter what anyone tells you sometimes little things may go wrong. The best radio salesman often knows nothing of correcting radio troubles—satisfy yourself.

Our Ozarka representative in your community will gladly put an Ozarka in your home for such a test. More than this, you will find that he is a thoroughly trained mechanic on our instrument. He has gone through a complete course of study under Ozarka Engineers, the men who designed and perfected the Ozarka.

3187 such men today can correct any trouble which may ever occur on any Ozarka instrument—more men are being factory trained daily. You wouldn't buy an instrument blindly—then don't buy service the same way Any radio instrument is only as estisfactory as the quality of service behind it.

Our Book No. 200 shows the full Ozarka line from \$75.00 to \$197.50, complete with all accessories.

A Few More MenareNeeded

In a great many counties we have the man we want. He is rapidly building up a permanent and profitable business of his own because he has an instrument that will more than meet all competition. More than this, he is trained to back up his sales with the kind of service that counts.

Many well established Ozarka representatives started by giving us only their spare time—their evenings. If your county is open you can do the same.

The investment in cash is very small. The investment in time necessary for study is considerable. It requires patience, but the results have enabled many men to get out of the salary and time clock class.

Any previous sales experience is helpful but not necessary. We can and will teach you how to sell.

Send for 64 Page Book— "The Ozarka Plan"



This book is entirely too sepensive 4s be sent out on postal early requests. It will be sent FREE to sep mea who smalls the scupon below and who is ready analous to emprove his condition. Tell us shout yoursell - ask for Ozarka Pap No. 100 and don that to give the name of your nounty.

OZARKA

120 Austin Avenue R. Chicago, Illanois GZARKA ...

(NCORPORATED

120 Austin Avenue I Chicago, Illimuis

Т	Continued I am amount forwarded to the SRES hard	The
	Gratiement. I my greatly interested in the FREE book Ozarka Plan" No 100, whereby I cannell your rack of parts	
	Contain Little Led for managed a comment April there	

			* *** ****
Address		City	* 4**4********
Parent Care	** *******	way.	
Committee of		. State.	

Gentiemen Without obligation send book "Osarka lastroments No. 200" and name of Osarka representative.

Name

Wester this Busson.

PERTERS ET WIRE CUTTERS

Powerful, two-handed tools for cutting rods, bolts, heavy wire, hard chain and for splitting nuts—in shop, garage, on construction, in the factory—wherever tools are used, a PORTER BOLT CLIPPER will be useful and a time and money-saver.

At the top of this column is shown a PORTER GI pper with standard side-cutting jaws. The tool illustrated at the bottom of this advertisement is a PORTER Clipper fitted with Angular Jaws. These are two of the several models in the PORTER fins.

A No. 3 Cutter has a capacity of 5/8" annealed polts in the thread Capacities of other sizes vary from 3 16" to 3, 4" annealed bolts.

Ask your local hardware or tool-dealer to demonstrate a PORTER BOLT CLIPPER to you, have him show you how easily and quickly these tools do their work



Me Home Workshop

The Eyes of an Attic

Simple Dormer Window Construction—Third Article
on Reclaiming Waste Space in Your Home
By Edwin M. Love

I P THERE are no attice windows or gables in which windows can be put, a dormer or two must be built to give light to an attice room. That illustrated in Fig. 1, which is suitable for the typical attice room described in this series, is comparatively simple to build. While the window thus obtained is high up from the floor, it serves its purpose very well

Plumb up from the floor plate to get the line of intersection between the side wall

and rafters. Decide on the location and width of the dormer (in this case, ari 8-ft gable centered on the rooff) and drive nail through the rooff at each aide of the dormer.

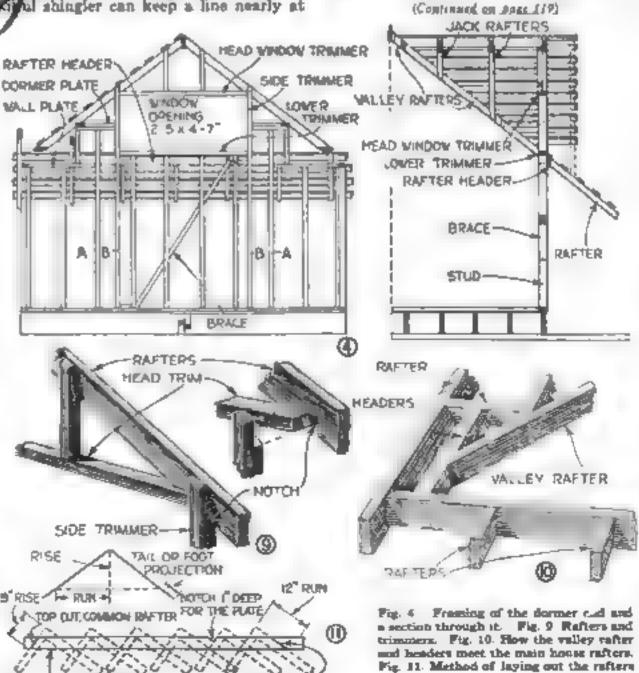
for out another and test off shingled from this base line to the ridge, "breaking thace" in such a way that when the dorner is spagled, now shingles may be filled but to the valley from the old. A shingle shingler can keep a line nearly at



Fig. 1. A permer window the ameteur woodworker can build without culty. The roof is shown as if partly broken away

right angles with the base, as in Fig. 2, page 119, but the amateur may find it necessary, upon rechingling, to tear off more obliquely to get water-tight joints

A jack, pictured in Fig. 8, is a great help in getting around on a roof. It consists of two pieces 1 by 4 or 6 in, and about 12 in, long, with ends cut to fit the pitch of the roof. Thin strips of wood or chingles connect the two to form a seat,



h This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

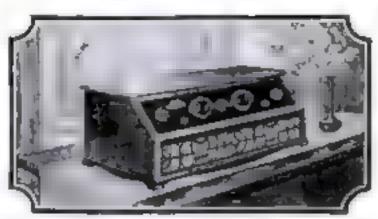
TOP OR CROWNING EDGE OF RAFTER

MUSIC MASTER SUPREME!

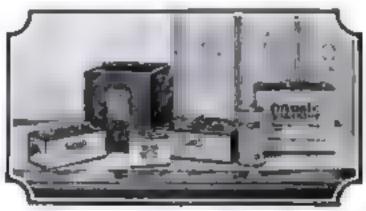
-as in Reproduction, so in Reception



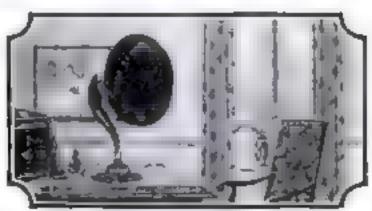
Played, Sung or Spoken before the Microphone-



Music Monter's Sensitive Mechanism Receives,



Enduse with Fower, Clarity and Volume.



Music Master Resonant Wood lasures Natural Tone Quality

ETWEEN broadcasting station and Music Master Reproducer stands Music Master Receiver to bring in today's wonderful New Era superprogram with splended fidelity of effect and naturalness of tone.

Music Master Radio Receivers incorporate every demonstrated principle of standard radio reception and reproduction.

Music Master Receivers furnish radio reception equal in efficiency to the world-standard quality of radio reproduction achieved in Music Master Reproducer. Perfectly balanced radio reception and reproduction are thus available to discriminating radio lovers.

Ask any authorized dealer to demonstrate for you what clarity in reception may really be—what distance range is really available—what selectivity really means.

See Music Master - hear - compare before you buy say radio set.

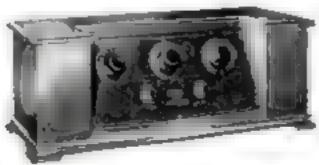
TYPE 40

Pive Tubes. Two stages of radio frequency, desector and two stages and o frequency Selective, good volume and distance Brown mabocany art funds \$60 cabuset, Proc. 1. \$60

> (Canadiga Prices Slightly Higher)



Ten Models \$50 to \$460 - Unconditionally Guaranteed



TYPE, 200

Five Tubes. New Music Master circuit, invo ving opecial adaptation to radio frequency. Very assective, good volume and distance Soid makes as property cabinet in brown realogany art auto finish. 5100

Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus
CRICAGO DESCRIPTIONS MOSTREAL,
Canadian Pactory: Kitchener, Dotario

Music Master products

⚠ This seal on a radio or tool advardsoment rignifies the approval of the PENTITUE OF STANDARDS. See page 4,

ة أبار أن الأراز الأراز الأراب والمحتب فعصص والمنطالة الأنان المتعالية والمتعالية والمتعالية والمتعالية والمتعالية المتعالية المتعالية المتعالية والمتعالية والمتعالي

Workshop Workshop

Steps in Cutting a Dado

A Useful Joint for Door and Window Frames Shelving, and Furniture

By Emanuel E. Ericson

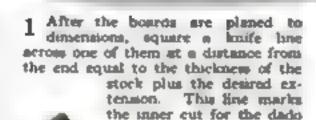
"a Cheney is my idea of a good hammer"

> It's surprising how many men who work with tools feel like that about the Cheney Hammer.

Some prefer it for its "Never Shp" handle, others like it for the Nail Holder in the head, others for the famous "Cheney Wedge" that keeps the head always tight. The curve of the claws, the swell of the face and the "hang" of the hammer—these things have built the Cheney reputation.

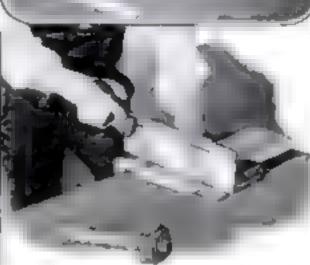
And behind everything stands almost 90 years of expenence in hammer making and an absolutely unlimited guarantee that if it ever proves defective it will be replaced without charge.







3 Unless you are an expert with the saw, it is advisable first to make a V-groove for starting the saw. That insures a clean and very accurate cut

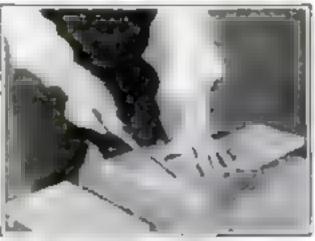


2 (Below) Place the second board on the first one, mark the width of the stock

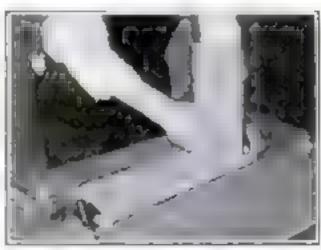
and square a second line across.

Then carefully mark the depth
of the dado with a gage

4 Use a backsaw or any fine handsaw Start the cut on the farther side and gradually lower the saw to a horisontal position. Cut exactly to the depth of the gage lines on both edges



5 Remove the waste wood with as wide a chisel as possible, working first with the bevel down and then with the bevel up. Test it with a square



6 If the dado is made accurately, the parts should fit without play when pressed family together. The joint may be fastened with glue or nails, or both

Making a cross-lap joint will be the next wood working operation to be illustrated pictorially in this series by Mr. Ericson in the December issue





You'll be a better "handy-man" if you have a

"YANKEE" **VISE**

"I'd do that if I had a visc," you say many a time. But don't get just any vise. Get a "Yankee," and secure features not found in any other.

It has a swivel base so you can turn the vise around to any position, And the vise even detaches from the base. A turn of a set screw-and off it comes holding the work. Take it to wherever you want to work.

As sides, ends, bottom and top are machined true, you can lay it down any way, and be sure of accurate work.

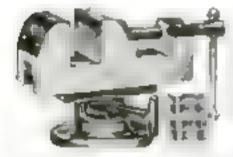
You can get a "Yankee" Vice with awivel base in the size most convenient for your work.

No. 1991-Jawa open, 11/4"

No. 1992-Jawa open, 2"

No. 1993-Jawa open, 234"

No. 1994-Jawa open, 4"



This tempte able his denet accel block with a h a p to mand differen lar shapes without marring.

Dealers everywhere sell "Yankee" Tools

"Fanker" on the tool you buy means the ut-most in quality, efficiency and darability

Write for FREE "Yankee" Booklet North Bros. Mrg. Co., Philadelphia, U. S. A.

Make Better Mechanics

The Mome Workshop

Trunk Carrier for a Ford

DDING a trunk at therear of the chas-

ste of our Ford sedan gives it some resemblance to the sport model of a more expensive car. It also provides a con-

venient place in which to carry blankets and tools—a storage place that is readily accessible without disturbing those who

are riding on the rear seat of

To attach a trunk of this type securely to a Ford car in no easy task. The origihal tire carrier gives a more secure contact with the frame of the car than anything that could be made easily. By cutting four rivets within the thre circle" of the carrier, the circle may be removed. The supports then are sawed off 10 is, from the frame in such a way that they can be bent toward each other to obtain two vertical surfaces. To these tire-carrier supports the front of the trunk aupports are to be fastened

Next, two bar from 14 by 134 by 2t in. are bent at a right angle at one end. The bend is 1 is, from the end and a 3u-in. hale is drilled between this bend and the short and of the bar to allow each piece to be bolted to a tire support. One inch from the other end and at two other places planned to come under the trunk, other hales are drilled. These trans then are bolted by their short ends to the lower hale in each of the original tire carriers.



Trunk attached to a Ford sedan

By H. D. Smith Another from bar of the same size is shaped into a broad U, bent at right angles at 1 in. from each end. The center part is long enough to extend from one auxiliary support, described in the next paragraph, to the other, or a distance of 2114 in. Thu tron is drilled so that it can

be belted to the Lahaped pieces under the trunk and to the auxiliary supports at each end.

Two reinforcing irons or auxiliary supports are hammered by a blacksmith from a 1/2 by 1 1/2 in har of steel. 42 m long. To make them fit on the frame under the car and also run past the old tire-carrier supports to the new gross piece, they have to be bent down shout 2 in and then back to a straight line on their top edge. They are holted to the U-shaped piece and to the original tire carriers as shown, and then strapped to the frame, of

the car, each with two U-shaped clamps

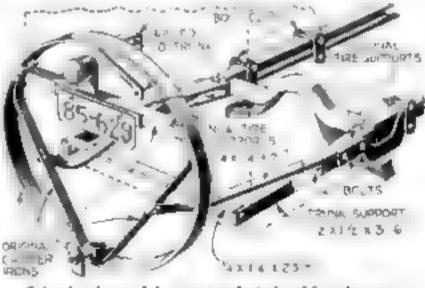
In order to insten the tire carrier to the back of the trunk, another brace, shaped like a triangle, is made and fastened with two bolts to the trunk. The tire circle then is bolted to this bracket at the top and to the two irons extending from under the bottom. An extra length of wire was found necessary to connect the talllight in the new position.

The trunk is covered with auto-top ma-

terial and the corners are trimmed with sheet gine 2 in wade, bent in the form of an angle fron.

The carrier on our Ford has been in use since a year ago last August. As we used the car shout town all winter long, we feel that it has proved itself a permanent fixture.

INLAMO broleum makes an excellent ton for the kitchen work table. Cut a piece the size of the table top and fasten with glue. A coat of varrish improves the wearing qualities.



Only six pieces of bar uron and steel and four clamps are to construct this durable truth rather for a Ford cut

Toy Used as Pattern for Paper-Weight

BY USING a baby's toy for a pattern, an ornamental lead or bram paperweight can be cast quite easily in any shop where there are the necessary facilities. Before assembling the flask, the impression in the cope is filled in partly so as to cut off the two lower legs and give a first bottom surface. The two upper legs are especially handy for holding a magazine or book open at a certain page, as illustrated.—HAROLD E. BENSON.



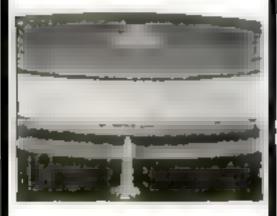
A novel paper-weight, especially meful for holding open magazines and shop reference bunks

~ and Now a Receiver Without Dials! Simple, 5 Tube Receiver trouble-proof, beautifulless accessories

10% ADDITIONAL WEST OF THE ROCKY MOUNTAINS

NO-DIAL is a new combination of tuned radio frequency and resistance coupling.

Simplicity of operation is amazing. NO-DIAL brings in near and distant stations by the mere rotation of ita coveri



Permanent Visable Station Record

The cylindrical NO-DIAL case is of spun aluminum, absolutely shielding it from body capacity. Finished in brown mahogany crystalline, matching the higher priced loud speakers.

Tube for tube the NO-DIAL recognizes no superior and on test it has outperformed many higher priced sets. If your dealer can't supply you write us direct and send his name and address.

GUARANTEED

The NO-DIAL is guaranteed against defects in workmanchip and material.

NO-DIAL is licensed under Blackmore patents and natents pending. Hogan Patent 1,014,002.

The Ohio Stamping and Engineering Company

Dayton, Ohio, U. S. A.



Cisten! Sweetly, clear, an overture—the prelude to a concert in a distant city floats into the room A touch of the finger brings it to you. No need to know about radio-no need to understand its myriad technical terms.

Modern Magic! An inventor's dream come true for you. A wonderful instrument is the NO-DIAL, so simplified, so devoid of the possibilities of trouble that one could literally operate it with case if blind. Here there are no dials to twist—none of the trying nervous tension that the adjustment of dials produces—just pure enjoyment. Be you ever so much of a novice, what you must do for yourself with other radio sets the NO-DIAL does for you. The set for every member of the family.

Scrap the log book—forget past radio disappointments. NO-DIAL is the griefless, worryless receiver you have been A ENGINEERING CO. waiting for.

Place your order now with your dealer if you expect to get delivery. The demand is exceeding all expectations. Accept no complicated substitute.

GENTLEMEN. e (Distributor) (Dealer) (Agent) (User)

Today

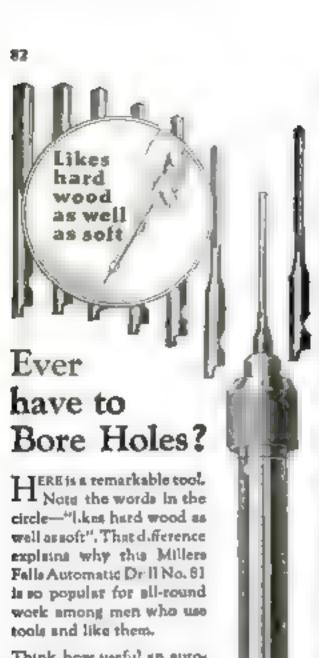
Dept. P. S. 11

THE

Daytun, Oblo

Without obligation on my part send me full details of NO-DIAL Receivers.

Use the coupon if your Street and Number dealer cannot thow you NO-DIAL.



Think how useful an automatic drill in Every time you drive a screw-No. 81 Is your friend, to make a clean smooth hole. To drive a pull in hard wood, or to evoid splitting other woods -let No. 81 make a hole first. As a help around the place, it ranks next to a ecrew driver. You need an automatic drill -and No. 81 left, A Millers Fallstool - and first class. At your dealer's.

MILLERS FALLS COMPANY

Millers Folls, Mass. 28 Warren St. 9 So. Clinton St. Chleago



Specifications

Eighe drill points, in handle magazine, sizes plainlymarked Improved bail chuck Improved shell, cannor be completely inscrewed and lost Spiral nut of Tobla bronze

Handle handsomely knurled

Highly polished and makeled overall

Length 1035", Weight, each, 9 oz.

Home Workshie

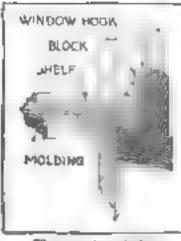
Self-Supporting Window Shelf

ODD lengths of m and a board 6 14 in. wade are what are needed to construct the ornamental, self-supporting windowabelf Lustrated

It can be as long an descred, but it should be cut out at the back to fit neatly between the window stops. The shelf is heid in place by the simple expedient of inserting a wedge between it and a common, booklike metal lift on the lower rail of the window. If there is

no lift on the window, a handle of this kind can be purchased at any hardware





This nest Wilhdow shelf for holding ported thewers requires no brackets or other unughtly supports

st re and screwed on. Should the window shife very easily, it is necessar to keep it locked while the shelf

Almost any molding that is on hand can be utilized for decorating the edges of the abelf.-JOHN J. BRINKOS.

Unique Letter-Rack Grips Papers Tightly

MOVING a lever causes this unsque letter-rack to close and hold securely any envelopes and papers placed between the four pasts of paper-holders

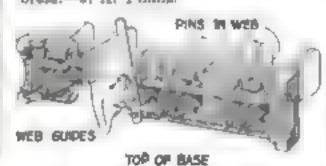


Musing a lever causes the four paper holders to open or close simultaneously

The device can be made in any size desired. The base, the edges of which may be molded or beveled, is mortised with four openings, as shown. The eight webs then are made and two small nails are driven into the edges of each to serve as the pivot pins.

The web guides then are arranged as illustrated, and each is fastened to every

other wah so that moving the lever one way will bring the top edges of each pair of webs together; moving it the other way, of course, opens the webs. In this instance, all the parts were made of birch. but any hard wood may be used. The lever and web guides could be made of brass.-J. A. Penez.



BEVELED EDGES CORNER LES BLOCK

Two views of the base and details showing how the webs are shaped and fastened

Milk-Bottle Cap-Opener Made from Hacksaw

BROKEN HACKSAW BLADE

How the hockup blade

is posited and best

BEND

WHEN the point of our mik-bottle cap-opener broke recently my wife

resorted to the familiar "thumb" method, with the not uncommon result - a shower of milk 1 went into the workshop for five minutes and returned with an opener that is much stronger and sharper than the usual commercial type.

It is of a type any one can make at no

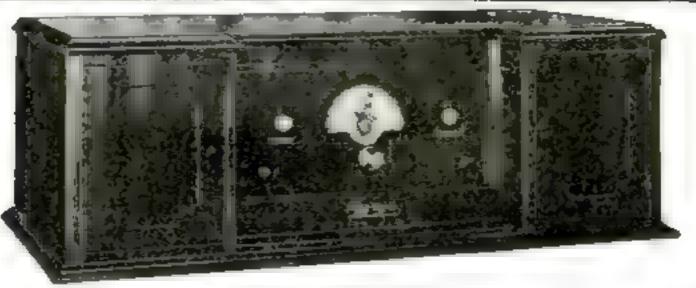
A worn-out hacksaw blade is snapped off in the vise to give a piece about 4 in

long. The teeth are filed or ground down and the end is feed to a point. The blade

> then is heated at the point marked"bend" in the flame of an arcaho, lamp or gas stove and bent by means of phers and vise After that it is heated red and quick y dipped in water to reharden the point extreme point is sharpened

on a grindstone or ollstone.

The heating and bending process may he eft out, but the opener works better if bent. - Exic B. ROBERTS.



Model A-Price \$175, Sockets Fit All New Type Tubes

MU-RAD Transcontinental Receiver

Welcomed By The Public

PUBLIC response to the sensational new MU-RAD Receiver with the Single Dial Control has been instantaneous. Radio enthusiasts throughout the Country were waiting for this advanced Radio receiver that gives country-wide reception with wonderful selectivity and volume.

One Master Dial Does ALL The Tuning on this Remarkable Receiver

The new MU-RAD Transcontinental Receivers are tuned by one control only. No other tuning adjustments of any kind are necessary. The tuning is extremely sharp at all wave lengths and the receiver may be used on any antenna in any location. Here, at last, is a truly GREAT Radio Receiver! You must see, hear and tune it yourself to appreciate it.



Model B—Price \$125
Sockets Fit All New Type Tubes

Ask To See The MU-RAD One Dial Receiver At Your Dealers
And Tune It Yourself.

Write Dept., D-3 for handsomely illustrated booklet.

MU-RAD RADIO CORPORATION

Partary Asbury Park, New Jersey



General fales Offices 972 Scond Street Newark, New Jersey



THINK there must be a whiff of tobacco in my blood. Fact u, I'm sure of it. My great-grandfather, a Vermont Inshman, went South in a wagon after the Revolution and he raised the first tobacco that was raised for export in what is now casled The Black Patch of West Kentucky and West Tennessee. Wise old Yank, he cured and



treated the heavy dark weed after crude processes of his own devising, loaded it on keelboats, floated it down the Cumberland to the Ohio, down the Ohio to the Mississippi and down the Musissippi to the Gulf, where he trans-shipped to saving vessels and sent his cargoes out to the Gold Coast of Africa to be barrered off for avory and good dust. I understand that, dealing with black tribermen, be rarely got the worst of a deal. For if he was an Irishman, he also was a New Englander. He laid the ulls for a substantial fortune.

His son, my grandfather, was a planter, a factor, a re-handler of tobacco; and on the side a merchant and a banker and a steam-hoatman. His small fleet of sternwheelers, manned by crews of his slaves and mostly expeatined by his own kinsmen, carried tohacco of his growing and his neighbors' growing to the city markets of the Southwest.

For his day he was a rich man until the Civil War came along and smashed him up. For he had bought Confederate bonds and had manced a battery of Confederate attillery

His son, my father, followed in the footsteps of his people. He was a watchouseman. Later be was a buyer for foreign governments and for domestic contractors too. He was accounted one of the best judges of types and grades in the district. He amoked incessantly and he chewed frequently

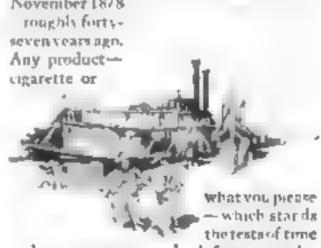
His son, meaning me, grew up with the smell of tobacco leaf in his young nose, with the jargon of its business in his ears. We lived on a tobacco street in a tobacco tuwn. There was a stemmery on the corper above us, a snuff factory and a cigarmaker's shop down the road and a whole row of warehouses farther along. In the season, the fat hogsheads blocked the narnow sidewalks. I absorbed the romance of the industry for it is one of the most romantic of industries-along with my hot biscuits and New Orleans molasses In four generations, I was the first of the

ask Grandad -he knows too The best smokes be ever had were

first-born males of my breed to stray from the ancestral pathway.

And now, in a way of speaking, I'm back again in the family line. I have taken on the job of doing a series of aigned advertisements of which this is the introductory one. I have declined propositions to turn out advertisements for various manufactured products because I feel I merely would be a hired hand, exploiting this, that or the other thing for so much a word. But I reached for this opportunity. I knew I could put my heart in it-could with sincerity endorse the article I was praising.

From time to time in this space, I'm going to write about Sweet Caporal Cigaretres. The first eigarette I ever smoked was a Sweet Caporal. That must be all of thirty-live years ago. If yen that far back Sweet Caporals had been on the market a good long while Commer a speaking, the Sweet Caporal Cigarette was born in November 1878



and competition and shifting popular taste for nearly half a century and boids its own and steadily grows in favor is bound to have merce. It just naturally has to have 'em. It shall be my task to try to explain a few facts about these

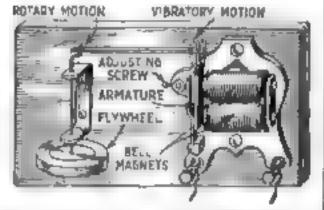
Thank you.

P. S. I worst our of thest articles every tree in a whole. Watch for the next.

High-Speed Toy Electric Motor Made from Ordinary Bell

A HIGH-SPEED electric angine may be constructed very easily from an ordinary electric alarm bell. The projecting cast-iron gong support is sawed off and the striker arm also is cut off about ½ in beyond the end of the armature. A strip of brass 1/16 in, thick and ¾ in, wide, of suitable length, is drilled at one end to receive the wire striker arm and at the other end to fit the crank on the flywheel shaft. This shaft is No. 14 hare copper wire. At one end it has a crank bent to have a throw equal to that of the armature atroke

Any wheel of mitable size and weight is fastened to the end of the shalt to seeve as



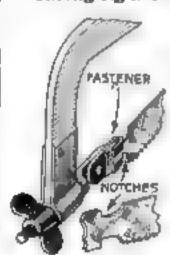
A connecting rad transmits the back and forth movement of the armsture to a creak shaft

the flywheel. The bearings are simply holes drilled in a U-shaped piece of 1/15-in-brass strap. Two wire rings are soldered to the shaft to keep it in place

The projecting end of the wire striker arm is bent over to keep the connectingred strip in place. A wire ring is soldered to the crank just above the connecting strip to keep it from slipping up

When the adjusting screw is properly adjusted and the terminals of the bell are connected with a battery or transformer, the engine will run very rapidly.—W. E.

Salvaging a Short Hacksaw



No MATTER how careful one is to keep a supply of hacksaw blades on hand, there are times when the last blade breaks. If one piece of the broken blade is fairly long, it can be relastened in the frame with the aid of a fast ener hent from sheet iron, braze, or even

heavy gulvanized iron, as shown. This also can be used for holding new binder that are too short for the frame with which they are to be used.—A. L.

As I use a good bit of mucilage, it occurred to me that the gum occing out of cherry trees in our yard might be useful. I found it an excellent substitute for gum srabic. It is dissolved in water and in hot weather a small amount of alcohol in added as a preservative.—
HENRY BISEOF



A Queer Way

of doing business, you may say, yet-

We urge you "don't buy-yet"—let us first prove the claims made for this umque shaving cream. Accept, please, a 10-day tube free

TELLING customers not to buy your product may appear an odd selling philosophy. Yet that is the way we brought Palmel ve Shaving Cream to top place in it head. We usee you not to bus it. But the start using state or expense. Will you grant as the courtery? We I shark you if you will.

immeasurably different

Palmotive Shaving Cream is based on new principles of akin care and beard softening. It is immeasurably different from any

cream you know

60 years of soap study stand behind it World's soap experts make it the makers of the world's leading toxict soap. Palmouve.

It represents 18 months of laboratory experiments, of over 130 formulas tested before perfection was reached.

It embodies the 4 supreme requirements 1000 men named as their ideal of a shaving cream, plus a fifth—stronger hubbles.

8 men in 10 who try it, stay with it. A great many of its users were won from twal preparations. Such success, you'll agree, does not come without reason.

5 new delights

These you'll find—these new that ing joys, these conforts unknown before.

| - Multiplier itself in lather 350 times

2-Softens the beard in the number

3-Maintains its creamy fullness for 10 minutes on the face

4-Strong bubbles hold the hairs erect

5 Fine after effects due to palm and ouve on contents.

10 Shaves Free

Now in justice to yourself, and in courtesy to us, please accept a 10-day tube free.

Give us a chance to prove our claims, Find out for yourself whether your present method is not failing in some important ways.

To add the final touch to shaving luxury, we have created Palmoline After Shaving Tale repetially for men. Doesn't show Leaves the thin month and firsh, and gives that evolutionally in Try he sample we are sending free with the tube of Shaving Cream.



8013

10 SHAVES FREE

and a can of Palmolive
After Shaving Talc

Simply insert your name and address and mail to Dept. B-1696, The Palmolive Company (Del. Corp.), 5702 Iron Street, Chicago, Ill.

Residents of Wisconsis should address the Palmolive Company (Wis. Corp.), Milwankon, Wis.

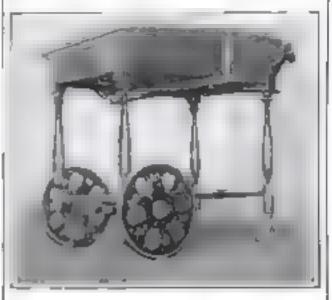


Workshop Workshop

Automatic Leaf-Raiser for Tea Wagon or Table

By H. Caldwell

EITHER a homemade or a commercial tea wagon or table with small drop leaves may be fitted quite easily with an automatic leaf-raiser. By throwing a lever at one end of the ten wagon or



Both the leaves of the ten wagon are related cignificanceasty by moving a lever at the back

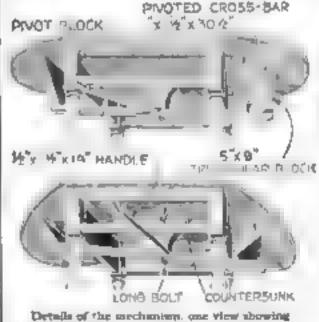
table, both leaves are raised to the level of the top and held firmly,

The dimensions of the various parts depend upon the size and construction of the tea wagon or table. Hard wood should be used. The stock required for the leaf-raiser illustrated was as indicated in the drawing. The width of the center and aide blocks must be the same as the

top and the bottom of the side rails. A hole is hored through the center of the pivot black to take a long bolt. The block then is screwed to the under side of the top in the center.

distance between the under side of the

The handle is let into the upper surface of the cross-bar at the center and is at

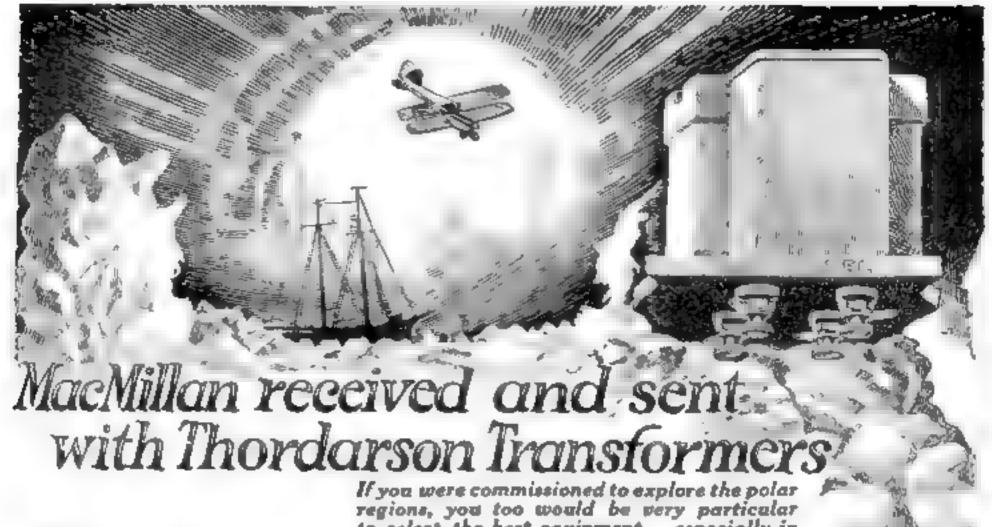


the leaves raised and the other partly lowered

such an angle that it will be as far over to one side of the tea wagon as possible when the leaves are down. A study of the chastrations will show the relation of these parts. A hole is bored through the joint to suit the projecting bolt in the pivot block

The side blocks are screwed on the leaves, the slope of one block facing in

(Companed on base 28)



RADIODUNE Thermlodyne, GLOBE Deresnadyne ADLER-ROYAL MURDOCK MU-RAD Silver-Marshall Newpor NUNN-LANDON KUSTOMBILT and many others

to select the best equipment - especially in radio, your sole means of communication.

PT HORDARSON Super Amplifying Transformers - the identical transformers sold by dealers everywhere and need in a majority of quality sets—have been the exclugive choice of MacMillan on his Arctic expeditions.

Surely no greater tribute can be paid to the actual supremacy of Thordarson Transformers, product of the world's oldest and largest exclusive transformer apecialists. Paultlessly they amplified programs and messages from great distances on the 1923-1924 expedition — and came back "as good as new." Equally successful was their performance on the last expedition.

The wisdom of MacMillan's choice infurther confirmed by the fact

of fine nets-makers of fine instruments especially noted for distance and superb tonequalities—use more Thordarsons than all competitive transformers combined.

that year after year, leading builders

In addition to Thordarson audio frequency and power amplifying transformers in his receiving sets. Mac-Millan chose Thorderson Transformers for exclusive use in his broadcasting station, WAP, on board the Peary. WAP successfully broadcast the weird voices and instruments of Eskimo entertainers back to civilization.

Thordersons cost more to build but no more to buy. Dealers everywhere. Interesting bulletins on amplification mailed free,

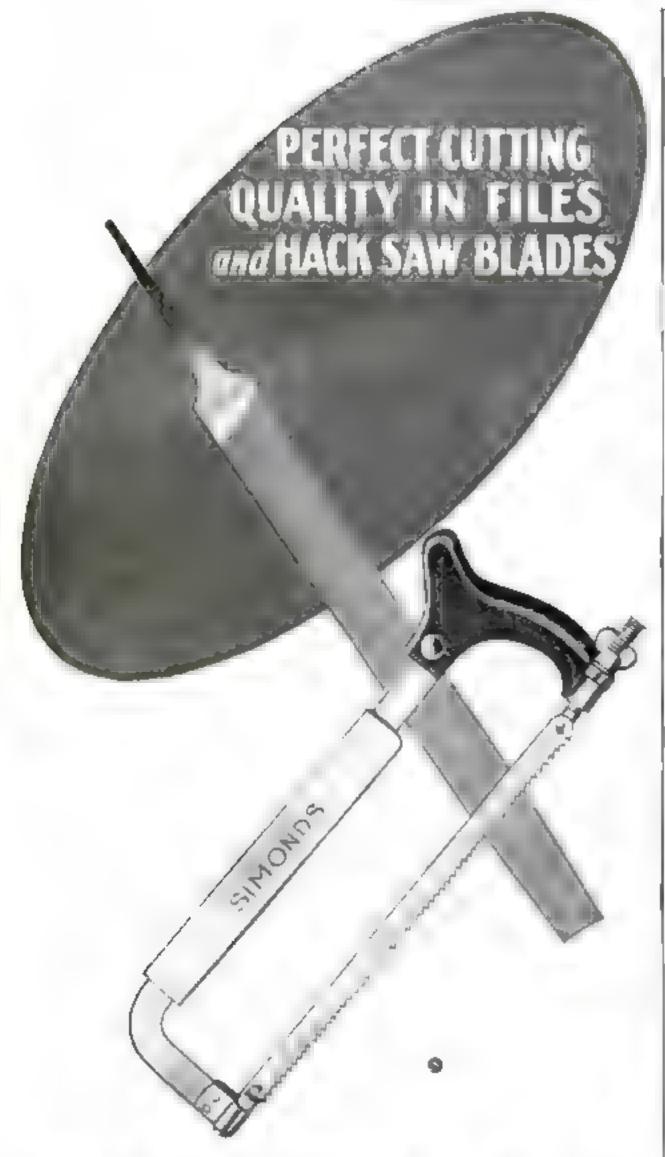
The Therdereus" Autoformer" All Fre-quency Amolifiers are our latest develop-ment. They amplify clearly the lowest as well as the highest notes of any instrument. An adoption of impedances, extistances and capacities. Write for the

Autoformers are \$5 auch, Other Thorderson Radio Transformers: Audio Fragmancy (subpanal or top mornling types), \$1, \$5, 3½ 1, \$4, \$1, \$4 50. Power Amplifying, \$13 the pair. Interstage Power Amplifying, auch \$8. If dampy annot supply, order from as.

THURDARSON ELECTRIC MANUFACTURING CO.

Chicago, U.S.A.

AMPLIFYING TRANSFORMERS Standard on the majority of quality sets



Pronounced 51-MONDS SAWS KNIVES FILES

SIMONDS SAW AND STEEL COMPANY, Fitchburg, Massichusetta

"The Sow Makers"

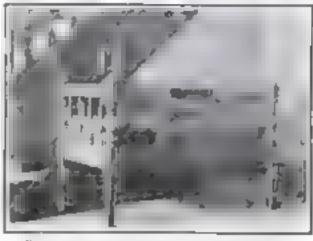
Branch Stores and Service Shops in Principal Cities

Codesiach em ou off

Unique Telephone Stand Made from a Discarded Crib

NEW idea in telephone stands is A illustrated below. It is made of a solid black walnut crib in which I slept when a baby

I sawed off the top of the high posts, removed one side, placed state across the bottom, and made a leather upholatered seat to fit within the rails. The telephone shelf is plate gam backed with green felt,



This telephone stand with its roomy comfortable apholstered seat was a beby's crib-

and below it is a rack for supporting the telephone directory.

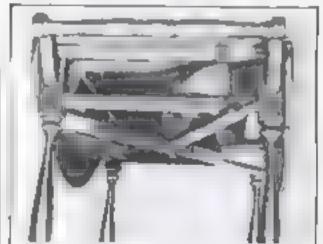
The seat is far more restful for tersphoning than the diminutive chairs ordinarily used, and also is a convenience when putting on subbers or westing in the reception hall for other members of the household.---LEO A. REINKE.

Automatic Leaf-Raiser for Tea Wagon or Tuble

Continuent from page fin)

the opposite direction from that of the other. The blocks are placed so that the ends of the bar extend about 14 in. beyond them when the leaves are up.

Bear in mind that the bar should be an long as possible, the length being con-



View of the tes wagon with drawer removed. showing leaf-raiser in lowest position

trolled by the diagonal distance from leaf to leaf when the leaves are down. Make a long slope to the side blocks so that the leaves will rise gradually; otherwise the bar will work hard and may

Working details of a tes wagon to which a leaf-raiser of this type can be applied are contained in Home Workshop Blueprint No. 13 (see list of blueprints on page 90).

Equip your set with Balkite Radio Power Units

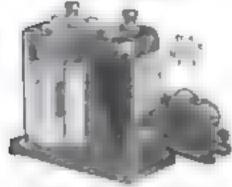
They provide unfailing, uniform current for both circuits



Balkite Battery Charger

This popular battery charger is en-tirely notations and can be used while the radio set is n operation. If your battery should be low you marely turn on the charger and op-strate the set. Charging rate 2.1 amperes. Operates from 110-120 AC 60 cycle cureves. Special model for 50 cycles. Also for 25-40 cycles with 1.5 ampers charging rate.

Proce \$19.30 West of Rockins, \$30 In Canada, \$27.50



Balkite Trickle Charger

Charges both 4 and 6 volt radio
"A" batteries at about 5 amperes.
Unble to 3 ways: 1 As a regular
charges with a low especity storage
battery for sets now using dry cells,
(1. With storage battery sets of
few tubes. Furnishes more parent
than and by 6 dry cell or 2 storage
battery tubes, so tha, if used durlag operation it need be used at no
other time. (1. As a "trickie" or
continuous charger for sets of agcontinuous charger for sets of as many and dry co. Or morage battery bates. Charging rate 2 5 amperes. Size 5 4 in. long. 2% in. wide 5 in. high. Operates from 110-120 AC 60 cycle current, Special model for SO cycles.

Low capacity batteries especially adapted for use with the charger with sets now using dry cells are being offered by practically ail lead log battery manufacturers this G.D.

Reputable manufacturers are also offering this full for use with the charger special switches which turn on Balker "B" and turn off the charger when you turn on your set. This makes the current supply for both "A" and "B" circuits automatic in operation.

Price \$10 West of Rockins, \$10.30 In Console, \$15

Equip your set with Balkite Radio Power Units. They improve and simplify radio reception, With their use your current supply is unfailing and always exactly what is required for each circuit. They reduce the amount of attention you give your set,

The popular Balkite Battery Charger is entirely noiseless and can be used while the set is in operation.

The Balkite Trickle Charger is especially adapted to sets of small "A" current requirements—any dry cell set, and storage battery sets of few tubes. It enables owners of sets now using dry cells to make a most economical installation.

Balkite "B" II is also well known. It was the outstanding development in radio last year. It eliminates "B" betteries and supplies plate current from the light socket. It fits any set,

The new Balkite "B" at \$35 is especially designed to serve sets of 6 tubes and less. With such sets it will perform exactly as does Balkits "B" II with sets of larger "B" current requirements.

Noiseless—No bulbs—Permanent

All Balkite Radio Power Units are based on the same principle. All are entirely noiseless in operation. They have no moving parts, no bulbs, and nothing to adjust, break or get out of order. They cannot deteriorate through use or disuse—each is a permanent piece of equipment with nothing to wear out or replace. They require no other attention than the infrequent addition of water. They do not interfere with your set or your neighbor's. Their current consumption is remarkably low. They require no changes or additions to your set. They constitute a complete, troublefree radio power equipment, one that is economical, unfailing in operation, and eliminates the possibility of run-down batteries.

Manufactured by FANSTEEL PRODUCTS COMPANY, Inc. North Chicago, Illinois





Balkite "B"

Eliminates "B" Batterios, Supplies place current from the light socket. Operates with rither storage battery or day call tubes. Keeps "B" citrust always operating at maximum efficiency, for with he are the plate current supply is never low. Requires no changes or additions to rour set. No bulbs—nothing to replace. Requires no attention other than adding water twice a

A new model, designed to serve istaroquiring not more than 20 mil-liampers at 90 vol :- practically all sets of 5 tubes or less, and most 6 rabe ages. Size B 4 in-lung, 8 mil-high, 3% in. wide. Occupies about same space at 45 volt dry "B" hav-tery. Operates from 110-110 AC 60 cycle current, Special model for 50 cycles. pet a requiring not more than 20 mile

Price \$35 la Conada, \$47.30



Balkite

The most outstanding developthent in Radio and season. Some 44 the new Balkite "B" but will fit any set including those of 5 tubes of more. Current capacity 40 millsamperes at 90 volts. Size 9 in. high, 6 = 16. wide, 7% in. deep. Operates from 140-120 AC 60 cycle current. Special model for 50 cycles.

Price \$55 En Canada, 575

The Unipower, manufactured by the Gould Storage Battery Combany, is equipped with a special Balkine Radio Power Unit.

Balkite Battery Charger · Balkite Trickle Charger · Balkite *B · Balkite *B"II

e Kraw



Here Are Two Husky Fellows For Your Tool

Box!

YOU'LL use them often, too-and bless the day you got them!

V & B Vanadium Hammers are made from V & B formula vanadium steel and handled with the finest hickory. They are octagonnecked and round facedwith a special non-slip claw that firmly grips either a brad or a spike. A V & B Hammer is a trusty helper on any job!

V & B Unbreakable Planes are drop-forged-not cast -from a solid bar of V & B Supersteel. They stand the falls that would break the ordinary plane. Furnished with all vanadium steel blades and walnut handles.

Your hardware dealer will recommend these tools. Ask to see them.



VAUGHAN & BUSHNELL MANUFACTURING COMPANY

Makers of Fine Tools

~ Chicago, III. U.S.A

CONTRACTOR SENTE SET

Suggestions for Constructing Valuable Christmas Gifta

FURNITURE and radio sets eank among the most durable and satisfactory Christmas presents. They have real utility and give lasting pleasure to those who receive them.



Gifts of this type can be constructed economically in even the most modestly equipped home workshop. To guard against disappointment in the finished product, however, it is advisable to follow well-worked-out plans such as those contained in the Home Workshop series of blueprints, listed below

If you wish to make a useful present for your wife or mother, you can choose such pieces as the sewing table (1), the kitchen cabinet (5), the ten wagen (13), or a chest (17 and 39). If the gift is for a man, you can select the smoking cabinet 2); for a man or boy, the beach (16) or m radio set (41, 42, and 48,, or if for children, a variety of toys (14 and 29)

Complete List of Blueprints

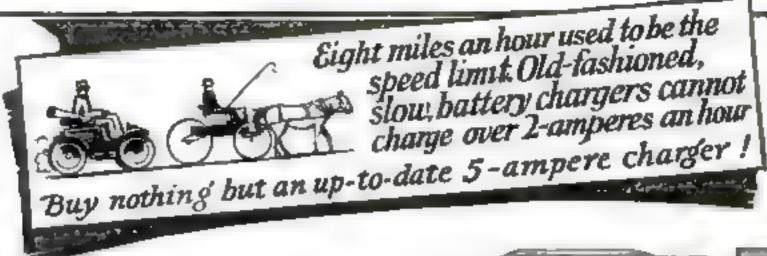
ANY one of the blueprints listed POPULAR SCHOOL MONTHLY for 25 cents. The Editor will be glad to answer any specific questions rela-tive to tools, material, or equipment. Blueprint Service Dept.

Popular Science Monthly 250 Fourth Avenue, New York GENTLEMEN

Send me the blueprint, or blue-prints, I have underlined below, for which I inclose

4		Tatle.	I'meda	hof	3 4 4
	1	Sewing Table	Feb.	'22	25c
	2	Small ng Cabinet	3d ar	22	35c
	3	Erad Table	Apr	33	234
	S.	Re hen Cabinet	Miny	22	25c
	fi.	Shaving Cabinet	June	13	25c
	9	Arbur Gate and Souts	Tofy	33	250
1	Ü	Perch Su na	Aug	22	75c
1	1	Beach and Tilt Table	Begit	22	35c
1	2	Street or Waller	Det	22	25c
1	Л.	Ten Wagen	Nov	23	25c
- 1	4.	Christman Toys	Dec.	'22	25c
1	5	Workshop Bench	Jan	33	25c
	á.	Inland Racho Cabinet	Prb.	23	25c
	Ť	Cedar Chest	Mar	13	25c
	Ш.	Phone Table and Stool	Mar	23	25c
- 1	4	Grandfather a Capck	Apr.	23	250
	3	Fint Top Deak	April.	3.3	25c
		Colomed Deak	Apr.	'23	250
	1.	Cabinet and Desk	Apr.	34	25c
	1.	Perg Kn Gerago	May	2.3	25c
	4	Gateleg Table	June	23	25c
	5.	Canne Barring Outfit	July	'23	25c
	5	Buby's Crib and Pen	Sept.	73	25c
		K chen Cabinet Table	De t	23	25c
	ь	Pul men Play Table	May.	13	25c
	P	Toy Ten Curt etc.	Dec.	.33	25c
	0	Tool Cubinet etc.	Jan.	724	25c
	1	Sewing Cabasets	Peb.	24	25c
	2	Chinese Game Table	Mar	'24	25c
	13	Dining Accove	Apr	34	2Sc
	4	Genden Trellines	May	134	25c
	15.	Simple Radio Cubinet	Oct	24	25c
	Щ.	Rudi Borrom Chair	Nov	24	25c
	17	Simplified Booksane	Dec.	25	35c
	JAL 391	Sheraton Table Salem Chest	Feb.	25	35c
			Pron.		15c
	iù.	Desk in Sharuton Style One Tube Redio Set	May	25	25c
	iż	Three Stage Amplifier	June.	25	25c
	13.	Four Tube Receiver	July.	135	25c
	-4.	A DOT & MOLETAGE	July.	43	4.36
1	V ₄	Me .		111	
		(Please prior,)		

City and State



The New Improved 5 AMP. A & B GOLD SEAL



Over 500,000 already in use

Three Times as Fast !

Better Because:→

New micrometer adjustment, hinged lid, and carrying handle.

No bulbs to buy or break

Can be used anywhere—conteins no acids or other harmful liquids to spill.

Approved by underwriterstrouble-proof, shock-proof and fireproof

Beautiful cabinet in maroon and gold,

Write for new edition of our instructive bookles on radio operation "The Secret of Dutance and Volume in Radio."

No more of the long, bothersome waits that were necessary when the slow, 2-ampere battery charger was the best that radio offered.

The New Improved 5-ampere GOLD SEAL HOM-CHARGER charges your battery overnight—it charges three times as fast as the slow, obsolete chargers that were last year's best. And it charges both A and B batteries without additional equipment.

Don't let anybody sell you an obsolete slow 2-ampere charger. You need a full 5-ampere charging rate for real efficient service. To be absolutely sure, insist on the GOLD SEAL HOMCHARGER.

The Kodel Radio Corporation

500 East Pearl Street

Cincinnati, Ohio



Owners of Kedel Broadcasting Seation WKAC on the Alon Hotel. Send for program.



BROWN & SHARPE Inspection insures tools which must be right

So exacting are the requirements of Brown & Sharpe inspection that no product leaves the factory until it is as nearly mechanically perfect as men can make it. The maintenance of such high standards for nearly 100 years has brought to Brown & Sharpe Tools their reputation of dependable accuracy.

Brown & Sharpe Small Tool Catalog No. 29 bets over 2000 different tools. Write for your copy today.

Brown & Sharpe Mfg. Co. Providence, R. I., U.S.A.

BROWN & SHARPE

"Standard of the Mechanical World"

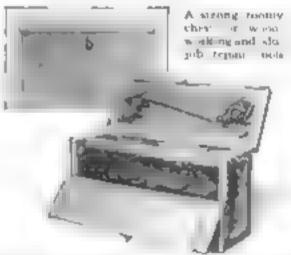
The House Workshop

General Utility Toolbox of Rainproof Construction

BUILT especially to be carried in a Ford car, the carpenter's too.box illustrated is an especially handy size and has the advantage of being waterproof. It is also an excellent toolchest for the home owner or farmer.

The top and bottom are 1/2 by 81 in. and 10 by 81 in. respectively, the ends 1/4, by 10 by 18 in., the front and back each are composed of 2 pieces 1/4 by 10 by 81 in., all being 1/4-in. dressed pine.

The end pieces are prepared first by nailing around their outside edges strips 1/4 in. Then nail the bottom board to the end pieces. Take the two front pieces and bevel one edge on each pieces so that the joint where they come together will slant downward to prevent the rain from beating in. Nail the lower



front piece on and then attach the upper piece with hinges. Bevel the joint between the two back pieces in the same

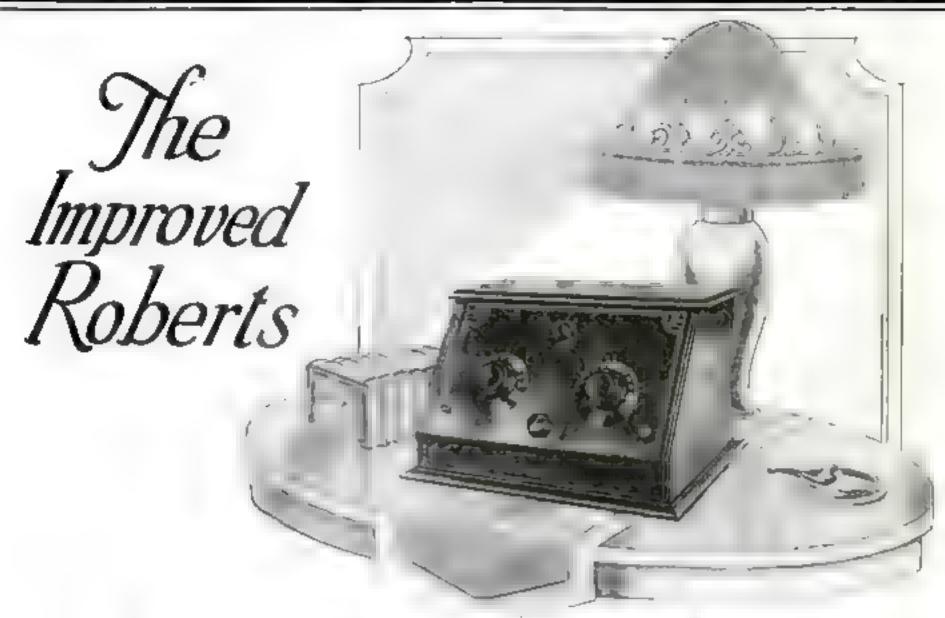
way and nall them on.

The lid should have four 16 by 116 in. strips nailed around the inside to keep it from warping. Fit binges and hasp Then take several laths, round one edge of each, and fit and nail them around the edges of the lid, letting the rounded edge project about 14 in. below the top of the box. Cut a piece of galvanized iron large enough to cover the top and bend down over these laths. If no sheetmetal shop is at hand, make the two longer bends yourself by bending the metal between two planks. Then place the metal on the box and bend down the ends, lapping the corners and nailing the edges with galvanized shingle nails. Paint the box inside and out,

Two saw racks may be fitted in the lid and a small tray provided for bits, rules, and small tools.—Thomas Stallings.

New Ideas for Your Christmas Gifts

NOVEL methods of preparing Christmas decorations will be featured in the Home Workshop Department next month. There will be an especially large number of suggestions on making toys and games. A page or more will be devoted to stunts you can do with a toy electric railroad. Other articles will describe gift furniture.



Approved by \$60\frac{85}{25} Ten leading manufacturers

The new Hammarlund-Roberts receiver is the united achievement of ten leading engineers, endorsed by ten of the best-known radio manufacturers. No one man's or one group's conception of five tube possibilities but the composite of the leaders' convictions.

This concentration of the leaders upon one purpose—the perfection and intense application of tried and proven radio principles has produced new results. Results so vital and so valuable that they put the Hammar-lund-Roberts far beyond your expectations of performance.

In designing this new standard of efficiency, the consulting engineers had at their disposal the finest parts the market affords—regardless of cost. They were not handicapped in building to a price.

These ten leading manufacturers offer to the American public greater value than ever before. A radio receiver constructed throughout of the latest, most efficient part designs at a price within the means of every one. A five tube receiver that equals the Super Heterodyne in selectivity and volume. A receiver so simple in design that anyone can build it from the instructions in the "Hammarland-Roberts Construction Book". You will wonder at this new simplicity this new efficiency this new saving.

Associate Manufacturers

All-American Radio Corp. Alden Manufacturing Co., Radioll Company Carter Radio Company Dubilier Condensers, Union Radio Corp., International Resistance Co., Hammarland Mfg. Co., Inc.

Write for this most complete book

Hammarlund Raderts Teceives

Send for this most complete book giving full instructions on assembling, wiring, and operating the Hammarland-Roberts receiver.

25c

N a-a I d sockets and disks, Carter Rheostats, Jacks a n d Switches approved for the Hammarlund-Roberts. Hammarlund-Roberts, 1182-F Broadway, N.Y.



The All-American Radio Corp. contribute the Rauland Lyric Transformer to the efficiency of this new receiver.



Made in Salt Lake City

Guaranteed Radio Reception

GUARANTEE Buy a Utah and use it for two weeks. Compare 115 tone with the best the others are able to produce. If the Utah does not give better recep. tion return it to your dealer and he will relund your money.

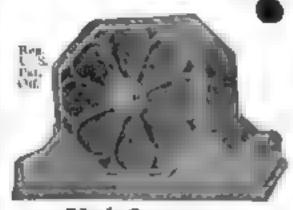
TOBODY—except Utah would dare offer a speaker on such a guarantee. We offer it as the best speaker made—and we let you test it in your own home to prove it to you. If you are not satisfied your dealer will gladly take it back.

Make This Test Today

Go to your dealer NOW. Don't be without the Utah speaker any longer. A test or demonstration will convince you.

Made of Semi-Hard Rubber No Vibration

All types have same unit. Q We are manufacturers not assemblers. Q Largest makers in America of any company devoted to the manufacture of speakers and units.



Utah Supreme \$25.00

BROADCASTING STATION KSL

Utah Radio Service Corporation will open a new station in Salt Lake City. Daily concerts will be given from the Mormon Tabernacle on the mammoth pipe organ. Watch for opening Announcement

Utah Superflex J. S. Pht.

UTAH RADIO PRODUCTS COMPANY 1427 & MICHBOAN AVENUE CHICAGO

Utah Standard For true reproduction of some the Utah Standard to unsurpassed. Wonderful natural tone and volume come maily from distant stations. For them who want the best.





John Werkship

Playing Host to the Birds

By William J. Edmonds, Jr.



You can play host to a surprising number of birds this winter if you spend the small amount of time necessary to make a simple bird-feeding shelter and keep it well stocked with suct and seeds all through the cold months.

The shelter illustrated is not only substantial and well designed for its purpose, but also is sufficiently simple in construction to be made by any one with the common tools found in every bousehold.

Almost any kind of wood can be used, but white pine, cedar, or cypress are easy to work and have excellent weathering qualities. If easier to obtain, material % in, thick can be used for the parts indicated as 15 in, thick in the drawing below

In assembling the parts, the post cleats should be fastened in place first with at least three screws fastened through the bottom into each cleat. The cleats, which should be spaced to suit the post or other support, prevent the pistform

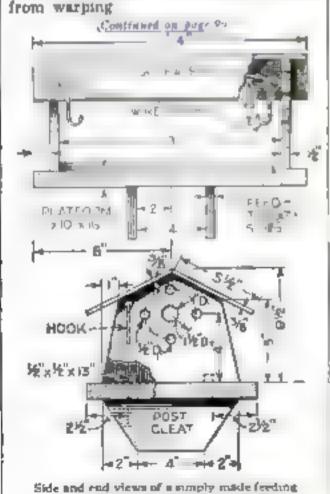
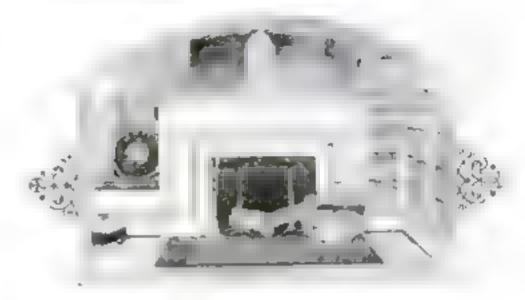


table or shelter for encouraging wrater birds



Smiling Interiors

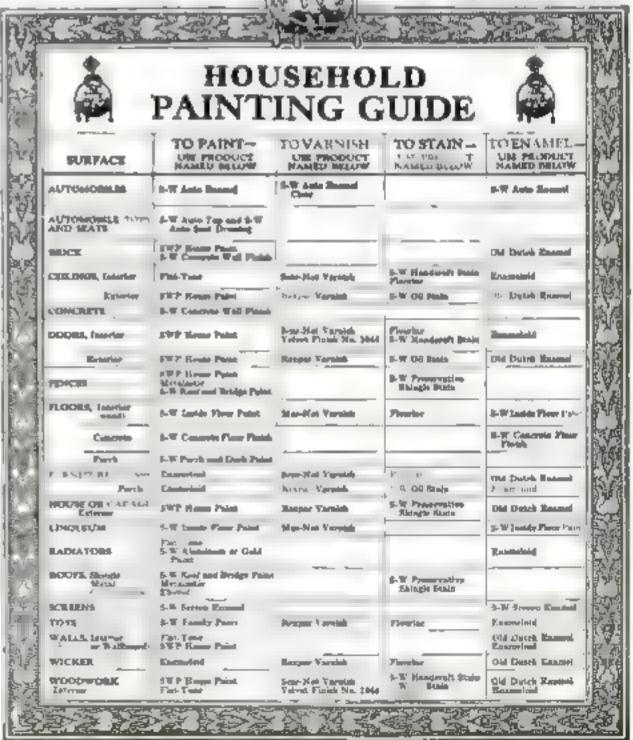
And every finish correct, as specified on the Household Painting Guide

SFE the special new Sherwin-Williams' Court Suggestions at Paint Headquarters in your own community. Nothing else offers such inviting help to those eager to make homes attractive. Be sure to see these latest ideas before decorating. If you do not locate Paint Headquarters through its sign and the Household Painting Guide write us. The Sherwin-Williams Co., largest paint and varnesh makers in the world, 659 Canal Road, Cleveland, Ohio.



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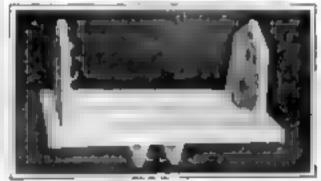
Playing Host to the Birds

(Continued from page 64)

The ends are lastened to the platform with finishing nails driven from the under side. The la-in, square strips, which prevent the seeds from being blown off the platform, are fastened with brade parallel to each other. The suet hooks are screwed into the inside surface of each end before the roof boards are nailed in place.

The feeding-table may be painted any color that blends with its surroundings.





The superate parts (upper view) and the shelter meembled ready for placing the roof

Brown or green always are satisfactery colors.

The ends should face in the direction of the prevailing storms to lessen the danger of the table's becoming filled with snow

Lumps of suct should be kept constantly on the hooks, as it attracts more birds than any other food. Bread crumbs, seeds, and broken nuts are relished by many birds

Giving Photos a High Gloss

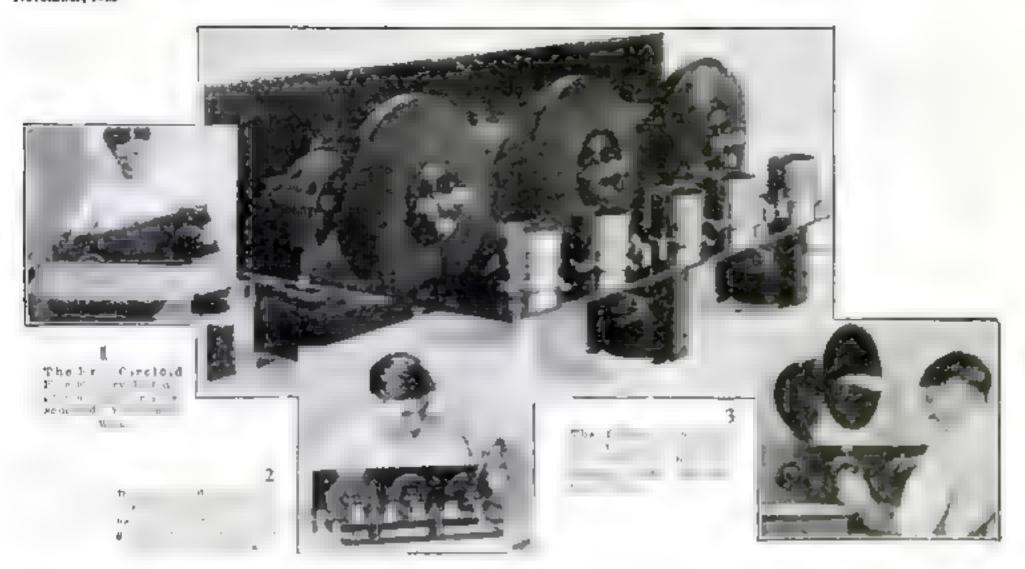
DROFESSIONAL photographers obtain high gloss effects on photographs by allowing the prints to dry on polished ferratype plates. The amsteur can do the same thing in the way illustrated.

When removed from the bath, the prints should be placed face down on



The prints are allowed to dry face down on the polished bottom of a developing-tray

the bottom of a developing tray and the excess water removed with a blotter and roller Polishing the tray bottom beforeband with a soft cloth on which a small quantity of wax has been rubbed, will prevent the prints from sticking -K B M



See how easy to build this amazing new type radio

WRITE immediately for the free radio book just published. It tells how thousands are enjoying the revolutionary new radio principle at a great saving by building their own sets. How 45 minutes of fun gives you a receiver that rivals in results the coatliest factory built John. Now anyone can do it a new casy way

Science has made a remarkable discovery. A new inductance principle that offers 4 great improvements over ordinary sets. It is based on a new kind of coil, the Erla *Balloon *Circloid, Only Erla can give it to you. See these 4 striking results.

- 1. Greater Detences. Circloids have no measurable external field to affect adjacent coils or wiring circuits. This makes possible higher amplification in each stage, with increased sensitivity and
- 2. More Volume. Higher r. f. amplification enables Circloids to bring in distant stations scarcely audible in ordinary sets with volume enough on the loud speaker to fill an auditorium 'Trade Mark Registered

book, "Circloid Hookups,"

3. Increased Selectivity. Circloids have absolutely no pick-up qualities of their own. Only signals flowing in the antenna circuit are built up.

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See how a few annutes of fun will give you the newest and most phenomenal set known to radio science. Examine it at any Eria dealer's, or send the coupon for full information, illustrations and dia grams contained in the remarkable new

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Hal nun Circlolds (4 coupler and 3 Lengalormerat Pall befructang for Incia I ng on your present re-PART ATO INr tided. Price \$13.

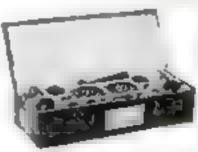
Erla Kit No. K-13

Consists of b Eria Balloon Circleide it reup or and 1 transformers) und 2 0002, 25. piate Erra Mink loan Condensery.



Comp ele instructions for installing in epen but. The combination gives you a spenuld a tube receiver Price \$21.50.

Erla 3 Tube Circloid Cir-Kit



Captaina absolute y every part pood in the construction of a 2 dube Erin receiver. from dri ad and engraved Bakel, se panel and atene led banaboard to

wood screws and wire. Every part tested und approved to pur labora inties and guaranteed.

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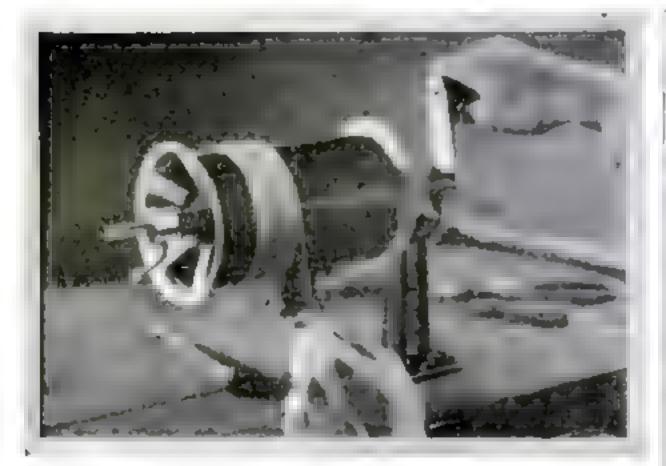
DI ESTRICAL RESEARCH LABORATORIES, oft Collage Grove Ave. Dept 12 H Chicago, fil.

What me the new book expanding the revolutennory vides pure recently discovered, most various Circlobi hookupa.

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For the fan who "winds his own"

YOU set builders who are winding tubular coils, induc-tance coils, and transformers for superdyne and neutrodyne circuits can do an expert job with this Goodell-Pratt Coil Winder. You can do the job at your own bench, a job worthy of the highest class professional, at a fraction of the cost.

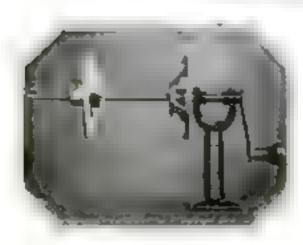
Holds any cylinder of cardboard, bakelite, or fibre up to 43/4 inches in diameter and 7 inches in length. The outer aluminum driving disc is adjusted to the cylinder length by a sliding collar, which can be locked at any point on the spindle with a thumb screw. The outside face of this collar is cut at an angle, affordting a cam action against the button on the disc hub, which exerts a continual tightening effect on the cylinder. And because both discs are cone-shaped, the cylinder is centered automatically.

The spring wound around the spindle prevents is from turning backward and releasing the tension on the coil wire. If unwinding becomes necessary, merely raise the loop and of the spring.

Nicesy finished in red and black enamel, and natural aluminum, with all exposed steel parts well polished. Length over all 14% inches, weight 3 pounds.

Other tools for radio builders. Write for special radio tool folders, which show all the Goodell-Prett radio tools, many of which are new and excusive Goodel-Pratt Inventions.

GOODELL PRATT COMPANY, Greenfield, Mass., U. S. A. Makers of Mr. Punch



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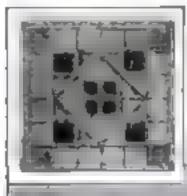
Coil Winder PRICE \$4.20

GOODELL-PRATT 1500 GOOD TOOLS

COMERTY WORKS IN THE

Decorative Teapot Stand Made from Mosaic Floor Tiles

ORDINARY mosaic tiling is a material useful for making many novel and decorative objects in the home workshop. As modern office buildings have floors in which these tiles play a promi-



This amque and coloria stanta for hot a shes a made of small 1 see set ph ceapering nusces no balcing pe do pedtery tues



nent part, the material may be obtained easily and at comparatively low cost.

To construct a teapot stand from mosaic pieces, a frame is required. should be 16 in, deep, buying inside dimensions of 5 14 by 5 14 in. This frame is given a coat of oil or white lead to prevent the cement from sticking to it. The frame is placed on a small board or table perfectly horizontal and the tiles are arranged to make any design or pattern.

After the tiles are arranged, Portland cement and fine stited sand are mixed in equal parts with sufficient water to pour This is easily. poured into the frame to cover the talem about 14 in A resuloreing sheet. of window screen 6 in, square then is pinced in the mold, after which the remander is filled with mortar.

The mortar may be left natural or colored either with cement colors or

BLACK BROWN RED **GREEN**

PRISIDE OF PRAME SEASER'S

How the form and the tile are made

antime, water-soluble powdered dye, such as can be purchased at any drug-store.

After the mortar has bardened sumciently, the frame is removed and the edges are amouthed up by means of a carborundum stone or a file. When the cement is stone dry, the edges may be enameled.—W. J. E.

Likes the Home Workshop

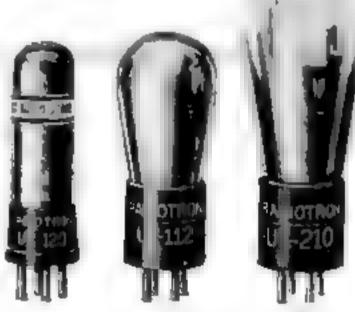
I HAVE been taking POPULAR SCIENCE MONTHLY for two years, and can truthfully may that it is the best magazine that can be bought. The Home Workshop Department has beined me a great deal, for my hobby is woodworking.—R. W. D., Fond du Lac, Wis.



three new power tubes

RCA, concentrating great efforts on the study of vacuum tubes, has developed three important new Radiotrons. They will be widely used in sets of all kinds in the last stage of audio frequency amplification. Their contribution to radio progress is greater power. They mean greater volume on dry batteries-and greater volume on storage batteries. They mean better tone, because they mean volume of sound sertbest distortion.

These new Radiotrons are now ready for general sale, after months of testing.



Radiotron UX-120-A new, powerful amplifier take that means great volume of sont on dry butterns. \$2.50 Radiocron UX-112—A new power tobe ismilar to the familiar UV-201 A, but reveal times as powerful, \$6.50 Radiotron UX-210-A super print tele, several trues as princeful at UX-120. Probably the most primeful receiving take in constence.

For details and technical desemption of the truct, peritt fü RCA office for the illustrated

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The Emblem of Worth in Radio

Acclaimed by a Nation



Fine takes, self-halanced tuned radio frequency, elepting paint field engineed, bandifield, massive, Adam beautinshapping out for compartment for butteries stational through larged for many tuning.

Volume and tone heretofore unapproached . , as mellow and true as an old Stradivarius... its range and power not even limited by the bounds of the continent, the LOGODYNE Big Five is an example of absolute perfection in radio engineering

Combining as it does the ultimate in performance with cabinet artistry worthy of the old masters, the LOGO-DYNE Big Five expresses in every detail, the standard of perfection required of the entire KODEL RADIO linethe best that radio offers.

Send for the new edition of our free booklet "The Secret of Distance and Volume in Radio Gues heipful Interesting information on radio operation.

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LOGODYNE "Big Fire" Con-sele Medat-the Artisatral of Radio bush-in load speaker, compertment for better its and charge \$275



LOGODYAF Standard Fine! Connecte Madel broade broads remputation for A and B but \$165 beries and charger



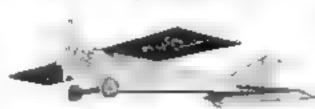
LOCODYNE "Standard Fine" ine cubes self-bulanced tuned radia fermiency sold engrated functional sold sub-trained battery control transfer beauty \$70 embedding policies. mahagan y cobinet

OTHER KODEL MODELS

Also manufacturers of the famous Gold Star line of low priced receivers, \$6.00 to \$30.00.

Send for Catalogue

Toy "Air Flivver" Whittled from Scraps of Soft Wood

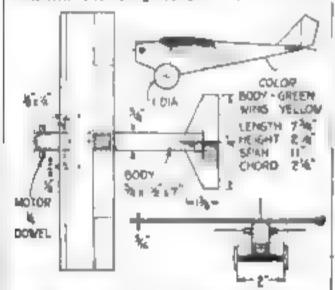


WHILE the day of the "air flivver" is not yet here, there seems little doubt that it is close at hand. Therefore a plane of this type should be included in every boy's collection of toy

airplanes.

Nothing could be much easier to make than the model air flivver illustrated The body is cut from a piece of soft pine or other wood 14 by 114 by 7 in. The Wing a shaped from a piece 3/16 by $2\frac{1}{4}$ by 11 in. A 14-in, dowel is glued in a hole through the nose of the machine so that the ends project 5/16 in, beyond each side of the body. This represents the simplified, light airplane motor of the future

A atrip 1/2 by 1/2 by 2 in. in nailed beneath the body to serve as an axic



Top, side, and partial front view of the toy plane, showing the principal dimensions.

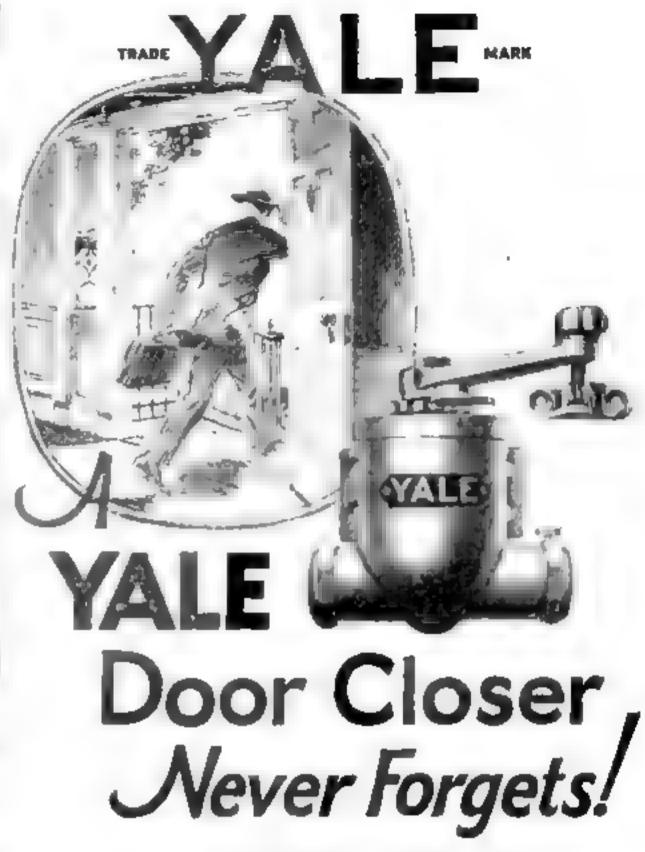
It carries two wheels 3h in. thick and 1 in, in diameter cut from a curtain pole.

The tail members and the propeller are tin, as in previous models, and the tail skid is a piece of bent wire

This is the last sirplane toy in the present series. A complete set, attractively painted, would make an especially welcome Christmas gift for any small boy, and the actual work of constructing them is relatively slight. The cost is nothing at all, except for paint.

In case you wish to build the entire series, you will find the first design, a toy air coach, on page 100 in the June issue; the second, a flying-boat cruser, on page 108, July: the third, a racer, on page 39, August, the fourth, an aerial express cruises, on page 109, September, and the fifth, a transatiantic air-liner on page 112, October

A gulck-drying, glossy, and brilliant paint for toys of this type can be made cheaply by purchasing a few cents' worth each of powdered whiting, lampblack, and bright red, blue, and yellow at a paint-store and mixing the colors as needed with white or orange shellar. A great variety of colors can be obtained by judiciously mixing the powders and there is no waste .- DONALD W CLARK



It is a door-closing power plant: perfect in action; made with the precision of a smooth-running engine; every part co-ordinated to the quiet closing of a door.

And like the perfect engine, the Yale Door Closer has its piston, cylinder, connecting rod and crankshaft, its ports, valves and bearings.

As the door is opened the power of a highly tempered seel spring is stored up waiting for release. As the hand leaves the knob the spring unwinds, promptly starting the closing action, and at the right moment, controlled by a piston working within its cylinder against hydraulic pressure, the door gradually losse momentum and comes to a quiet stop as the latch-bolt clicks in the (smb.

This is the action of a Yale Door Closer.

A type and size for every need-from the screen door of a home to the massive entrance door of a public building. Basy to apply. Easy to adjust. For sale, moderately priced, by dealers everywhere.

> The Yale & Towne Mfg. Co. Stamford, Conn., U.S. A.

Canadian Branch at St. Catharines, One.



YALE MADE IS YALE MARKED



Service cannot stop

The telephone, like the human heart, must repair itself while it works. The telephone system never rests, yet the ramifications of its wires, the reach of its cables and the terminals on its switchboards must ever increase. Like an airplane that has started on a journey across the sea, the telephone must repair and extend itself while work is going on.

To cut communication for a single moment would interrupt the endless stream of calls and jeopardize the well-being and safety of the community. The doctor or police must be called. Fire may break out. Numberless important business and social arrangements must be made.

Even when a new exchange is built and put into use, service is not interrupted. Conversations started through the old are cut over and finished through the new, the talkers unconscious that growth has taken place while the service continues.

Since 1880 the Bell System has grown from 31 thousand to 16 million stations, while talking was going on. In the last five years, addstions costing a billion dollars have been made to the system, without interrupting the service.

> AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ASSOCIATED COMPANIES

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Me Home Workshop

How to Build Book-Shelves without Wasting Space

By Roger L. Bridgeman

WHEN we moved into our newly acquired home, we found no place to put our books. Lining up the books side by mide, the surplus from our sectional bookcase measured over 45 ft.

Irutend of building shelves and fitting our books into them, we designed the shelves to fit the books. We laid out the volumes on the floor according to height and found the upaces between the shelves that would best suit them would be 8 14, 0, and 11 in. The volumes averaged in height an inch less than the space.

The three heights were together with the thicknesses of the



The books were measured before these shelves were built to insure a place for every volume

shelves, and a 15g-in, space was allowed between the bottom shelf and floor, giving 34 ab, as the distance from the upper shelf to the floor. The ends of the book-shelves were designed to go above the top shelf 4 in. to accommodate a few small books in the corners

By dividing the total length of the books by three, it was found that shelves totaling 15 ft. in length were required. As we had 18 ft. of wall space, the shelves were made a little longer than necessary to allow for the expansion of the library

Any construction might have been used, but that chosen was to mortise the shelves through the ends and hold them in place with pure made from a new garden-tool handle. A piece was cut from the side of each peg with a saw to give a wedge-like effect for drawing the joints tightly together

If the book-shelves are to be painted, white pine or whitewood can be used; or if the wood is to be left natural or stained, time oak of ash

Shop Holder for Magazines

WHENmaking something in the shop from an article in POPULAR SCIENCE MONTHIA I find the best way to prevent the magazine from getting soiled is to hang it above the bench with the type of trousers hanger shown H. E. B.



A trousers hanger bolds magazine opet



R. H. HARRIMAN

America a Manner Rail

road O gameer

W decawage haya

apocating the r

Lonel No. 1 Rail

road Bustene to

day, are justened

to be the rail road

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OF course a Lionel Railroad looks

It is real. The only difference between Lionel and real trains is the size.

Lionel Engineers take care of that. They design and build Lionel Railroads electrically and mechanically perfect, so that they run like real railroads. They work from the engineers' drawings and blueprints of real railroad locomotives, coeches, freight cars, signals, crossing gates and the many other railroad accessomes.

Lionel Model Railroads are way beyond ordinary "toy railroads." They are valuable educators. They are belp-

> ing American boys to learn how real railroads are run, how the passengers and freight of the nation are transported.

> Running a Lionel Model Railroad is exactly like running a real railroad.

This wonderful realism can be found only in Lionel Model Railroads and Accessories.

Lionel Automatic Trees Control. The greatest achievament in model radical augmentos. Starts and state trains automatically. Just one of the many manderful realistic radical days in the Lionel line of Accessories.

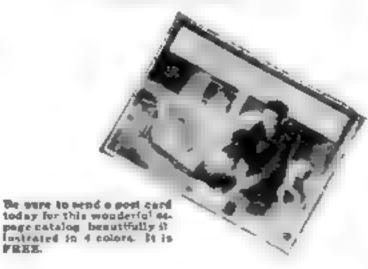
That's why American boys buy more Lionel Treins than any other make. That's why Lionel has been "Standard of the World" since 1900.

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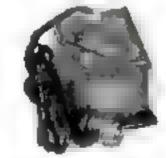
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ONELECTRIC TRAINS

"MULTIVOLT" TRANSFORMERS



NOW you can build a set and have both tuning diale tune exactly the same—or, you can build a one control set using a gang condensor and know that it's going to work right. AhRO Coms are matched.

But—the matched feature of Auro Coils is not their only exclusive feature.

Acro Coils are, by electrical measurement and by use tests, among the most powerful, most selective and most sansitive inductances ever designed. They will onable your set to sharply cut through powerful locals and will bring in, with greater volume, signals you have always had to listen to on head phones.

Build with Aero Colls. You are sure of their superiority because that which makes them so is patent-protected. The Tuned Radio Frequency Kit is \$,2.00 complete with circuit diagrams and instructions. At your dealers -or direct, if your dealer ham't them.

Free booklet giving columbic information on radio frequency amplification sent on re-quest. Write now for the "Aero Booklet"

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Use AERO COILS

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Radio Frequency Regenerative Kit



Makes as powerful and selective a 6-tube, non-radiate or set as a pre-public to build, Matched - - \$12.00



Wave Trap Unit Also for Coperal Sers Makes an exceptional-ty officest wave to p for certain net - 54,00

Oscillator



Ттетенфиция политический выпуска of the outsidence circuit in any Super Reterodyne receiver



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2227 Witte Building, KANSAS CITY, MO. 2227 Empire Building, PITTSBURGH, PA.

We House Workshop

Greeting Cards "Written" with a Pocket-Knife

NOVEL name and greating cards can be made quite easily by cutting the lettering and ornamentation into a good quanty bristol board or cardboard with a sharp pocket-knife.

The cuts are made at an acute angle to the surface and do not, of course, penetrate right through the card. They simply raise a certee of sharp edges, each



Photographic reproduction of a unique card to which the anos are cut with a pen-limite

of which throws a shadow and helps bring out the design. The effect is shown clearly in the accompanying reproduction of a card 3 4 by 5 1/2 in., which was cut in 15 minutes by Elisha R. Wilkins, of Wallace, Idaho.

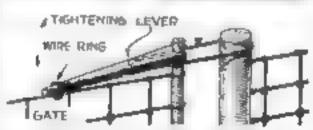
The straight lines in this decorative lettering are made with single cuts, but the cross lines are worked out mainly by a series of short cuts placed close together. The crispness and delicacy of the lettering obtained in this way is surprising and, of course, cannot be appreciated fully from the photograph.

Tightening a Wire Gate

SAGGING gates often mar the appearance of an otherwise well kept wire fence. Especially is this true when the gates are of considerable length

A quickly made tightener for a gate can by made from a short piece of wire and a stick as shown. One end of the atick in hollowed to conform to the shape of the gate post and the other end in tapered slightly. A piece of wire in inserted through a hole in the middle

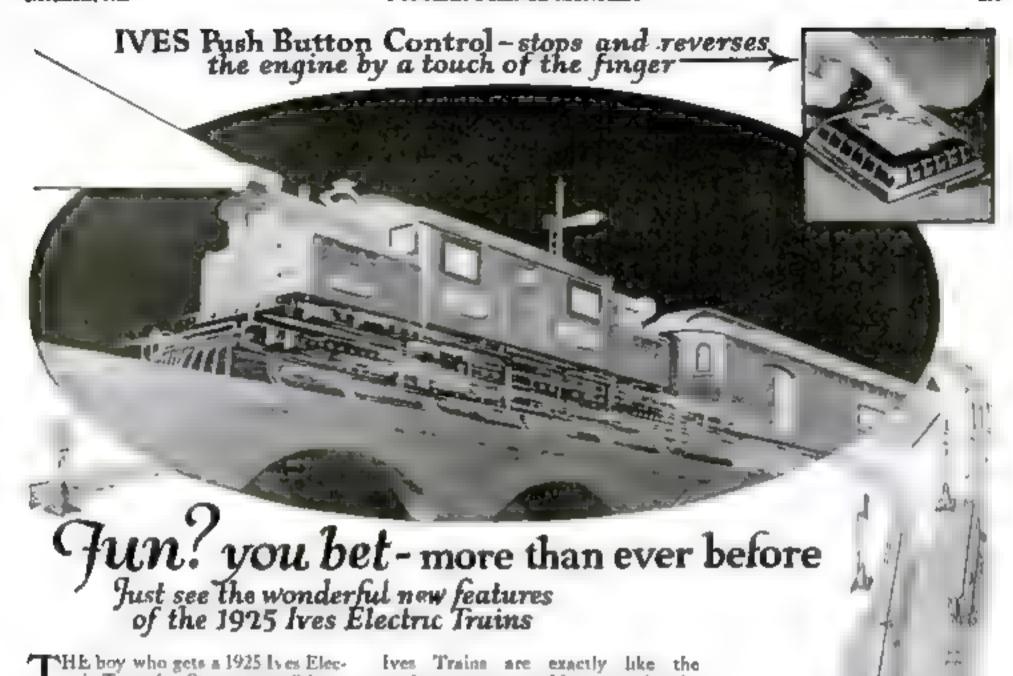




Only a wooden lever a length of wire, and a ring are needed to make this gate tightener

of the stick and wrapped around the fence

To tighten the gate, the stick is drawn down and held by means of a wire ring, JONAS J BYBERG.



"HE boy who gets a 1925 Ives Electric Train for Christmas will have the most realistic, up-to-date and powerful train in all the world.

The Ives electric reversing locomotives (Series R) are the only locomotives that reverse electrically by a touch of your finger. You set this control switch for the speed you want. Then just a pressure of your finger on the button-the engine stops! Another touch—it backst

Only in Ives Trains can you get all these up-to-date improvements

It's a great sensation to see your locomotive reverse itself electrically at any position on the track without touching it by hand.

Remember, boys, no other trains but lves have electric reversing locomotives with the automatic push button control. It isn't a crude mechanical device on the locomotive or track, but a real electric automatic control operated from the switch. And this year you can have an Ives Electric Reversing Locomotive on O-gauge or 21/4-gauge track.

ives Trains are exactly like the modern equipment of lamous rathroads. Cars are electrically lighted and attractively finished in every detail. Every locomotive has worlds of power and a strong chassis so it can pull long trains at express speed. motors in the lower-priced locomotives are as carefully made as the big ones and are as powerful in preportion to their size

There is an almost endless variety of passenger and freight cars, electric target signals and semaphore signals with electrically-operated arms, bridges, tunnels, stations, and the efficient lves Transformers. Prices range from the \$1.50 mechanical train to the big complete \$50 electric outfit.

32-page book in colors tells all about the new features

SEND for the new 32-page book of Iven Trains and Accessories. It contains illustrations in colors or the full line and tells all about the new 1/21 teatures exchange with Ives

Mai, coupon today with 10

Toy, department, electrical. hardware and aporting goods stores sell Ives Trausa

Speed me on my way to Bridgeport -I'll bring

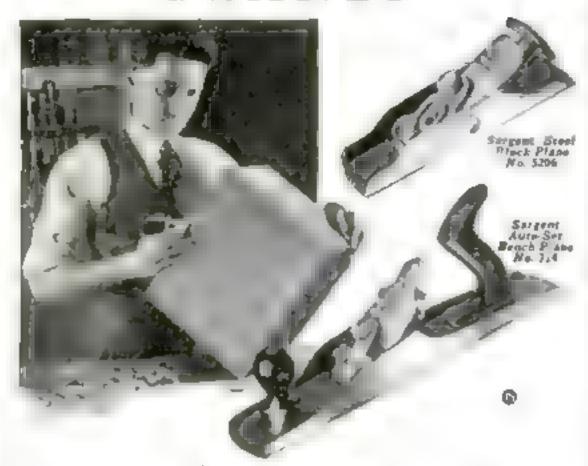
THE IVES MANUFACTURING CORPORATION Dept. E2, 198 Holland Ave. Bridgeport, Conn.





SARGENT

PLANES



Be sure the planes you buy come up to Sargent standards

YOU may never have to put your plane to the tests that most carpenters give theirs. Nevertheless you want your work to have the finish that only the best of planes can give. The same qualithe choice of carpenters should govern your selection.

Surgent Construction: Wensresisting materials are used throughout. Chromium steel is used for the cutters-en unbanally tough metal that takes a keen edge and holds it

Surgent Performance: Absolute rigidity of cutter, even across and against the grain or over knotty surfaces. Adjustments quickly and easily made. In the Sargent Auto-Set (the larger plane illustrated) the cutter can be removed, sharpened and replaced without changing original adjustment.

Sergent Economy: Sargent Planes are moderate in cost and prove a real economy by improving work and saving time. Seldom if ever do they need repair or replacement.

The two Sargent Planes shown here should be in every home and school workshop. See them at your dealer's. Write for booklet.

SARGENT & COMPANY, Manufacturers 50 Water Street New Haven, Conn.

Make More Money

Read the Money Making Opportunities on pages 144 to 174 of this issue.

Get Boice Prices Before You Buy!

Granter topique us lower (ath in early a court or minory has a partners. Let Book Craim large another do your work and open and professional Desire to plan have proved and he Bolec E I lay Plan before you has

8 Inch Bench Lathe

Junior Saw

Total mood and safe moral. Defines 8-ch. mentiones over bed.
Consectly III by, between content. 3-ch is bede they bendefined in CV is those of all ment contents of the mention of the men

Sharehard makes poon 1 o V the pric sample ple A 5 of the 10 A Price word sweep and L a by that a general of policy. Here, is being ingo. I communicated 100 per rand, merchand.

1/2 H. P. Motor \$13.96 This special after one beaut in regular primary that Made for an expectation accordance. Fifting P. O. N. Tainde. Cook a trip order only hydrichectum grantmations. Social states

W. B. 4 J. E. BOICE Days P S. II. A Teleda, O



Tie Kone Werkelie.

Small Woodworking Vise Made from an Old Auto Jack

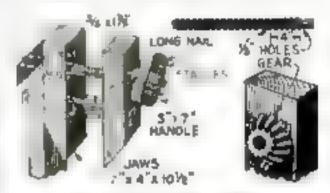
FROM a discarded automobile jack of the screw type and some adds and ends, I made the useful bench vise illustrated.

Two precess of hard wood 2 by 6 by 10 4 in. are cut as abown to form A hard wood strip 👫 by 1 % in. and as long as the jack screw. us mortined nobidly into the lower part



of the outer jaw and pinned in place This strip, which slides through a slightly larger mortise in the rear jaw, bas a series of holes drided in it to take a large not The nail to placed, what the vine is in use. in whichever hole is most suitable for the work in hand, the purpose being to keep the outer vise jaw from turning and, at the same time, parallel to the rear

A hardwood handle 32 by 5 by 7 in. is fastened to the jack screw by means of



How the parts of a light wrew Jack are utilized in marmbling a beach visc

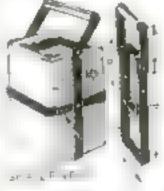
3 washers, 2 natis, and 2 staples as shown. The nut for the vise screw, which may is a part of the original pack, is fastened with screws at the back of the rear jaw After the vise is assembled it is buited to the bench. - E D THAUDELS

Folding Carrier for Ollcan

EMPTY 5-gal motor ofleans, which nowadays are so common around farms, can be transformed with little trouble into buckets for carrying water, feed, and various supplies.

To make a collapsible carrier for this type of can get about B ft of 1-in hoop from and half a dozen small copper rivets. Cut two strips 5 in.

long and two S ft long. These are bent and riveted as shown and a wooden handle added. When not in use, the carrier should be folded and stored indoors or otherwise well painted to prevent rust. - A. E. Zip-PRICE



Oilgan currier

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 4.

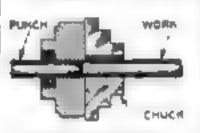
How to Center Work Quickly for Turning in Lathe

By Howard Greene

ENTERING small work in a lathe Can remain and is more difficult than centering rods or bars from 34 in. up. The main trouble is that once the punch mark is made, it is hard to change its position, especially if only a night adjustment is necessary.

This difficulty can be overcome and much time saved by the use of a selfcentering chuck and a special punch. The principle is the same as that used in bell centering punches; but if a chuck is avallable, it is as good and in some respects better and will handle larger work. One advantage is that it makes no difference if the end of the rod is not square cut, although in all cases it should he aquared up before being put in the lathe, and the very first turning operation should be to face the end properly down to the lathe center.

The chuck has a hole clear through the body. In the case of a 2-in chuck the smallest size, the hole is 1/2 in. Make a



Punch used with selfcontinuing lathe church

steel center punch of whatever mae the hole in the chuck is, and have it a very good fit, so that it will go in easily but without any looseness. Turn the

point in the lathe so that it will be exactly in the center and make the anglethe same as that of the lathe centers. Then, if the work is very light, the punched centers can be used without drilling. For good work, however, and for the protection of the lathe centers, it is better to drill, so that the lathe centers will not have their extreme points worn.

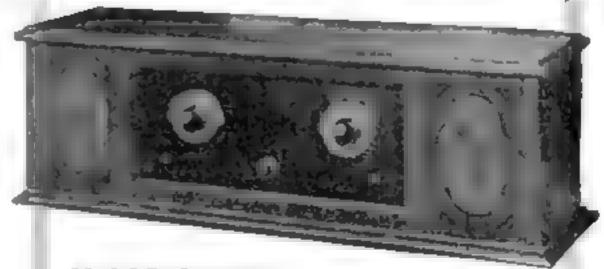
CLAMP the rod in the chuck, pass the punch through the hole in the back until the point rests on the end of the red, put the other end of the red on your navil or something solid, and give the punch a light tap, and the job is done

For a rod under to in it is better to use the outside jaws of the chuck Obviously, any work up to the full capacity of the chuck can be centered. The chuck is not harmed in any way, provided the projecting and of the rod is always supported when using the hammer on the punch

If the chuck is mounted on a plug that fits into the taper hole in the spindle, so that the hole in the chuck m filled up, it still is possible to work the scheme, though not quite so well. A very short punch may be made, merely a cone that can be supped into the chuck from the front, point out. Then put the rod in the chuck, with the jawa screwed in only enough to steady the rod, and press hard against the punch point. This will make a good mark that readily can be deepened afterward. Using a hammer would be likely to start the plug and throw the chuck out of truth on its mounting.

Preliminary Announcement

ALL-AMERICAN RADIO RECEIVERS



Model R: Price 190™

There will be available thus fall a limited number of radio receivers, produced and wired complete in the big, new ALL-AMBRICAN factory, and bearing the world-famous name ALL-AMBRICAN

Many hundreds of sets have been constructed in the ALL-AMERICAN laboratories. Most of them have performed in a manner which, in less experienced factories, would have caused joyful excitement. A few of these sets have shown results truly remarkable even when measured by the All-American standard, but E. N. Rauland, pioneer in radio and severest critic of All/Annucan products, shook his head and said Wast."

And he was wise. If this achievement had not come until next year, it would still have been worth waiting for But it is on view at the shows.

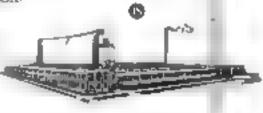
Last year it was our please ure to add to the family of the "World's Largest Selling Transformers" an audio amplifying instrument embodying features bitherto considered

impractical, outside the laboratory, on account of their high cost. This new transformer, Rauland-Lyric, has in one season revolutionized the toneamplifying art. And now, in the same spirit, we offer the ALL-AMERICAN Receiver.

ALL-AMERICAN Receivers embody, necessarily, all the genuine unprovements of the past year in radio reception many of them the especial product of the ALL-AMERICAN laboratories. Multistage control through two 360° dials, tenthout gears, the elimination of "body capacity," the extreme of beauty in tone through Rauland Lyric, and of distance, power and selectivity through ALL/AMERICAN Straight-Line Frequency Tuning these are combined with the utmost beauty and permanence in external appointments,

And yet, ALL/AMERICAN Receivers are not high priced This is due to the fact that, although only a small number will be produced this fall, the price has been set on the basis of next year's extensive pro-

Dealers who realise the significance, for future growth, of handling merchandise of this character, are invited to write. their jobbers or the factory for full information, or to visit our booth at the Chicago or St. Louis radio shows.

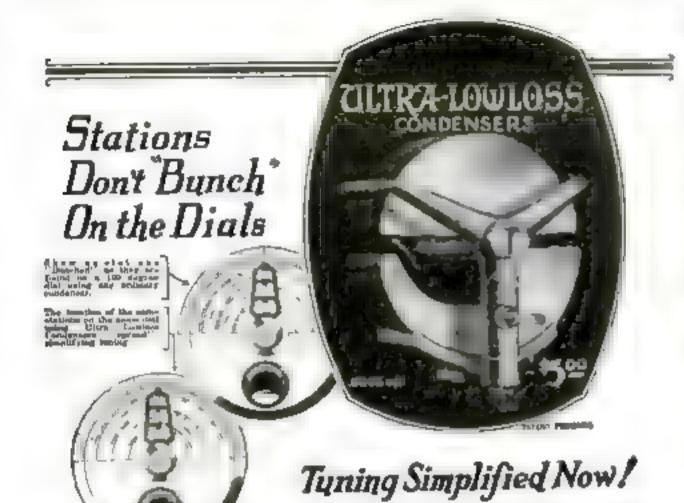


ALLAMERICAN RADIO CORPORATION

E. N. Rauland, President. 4215 Belmont Avenue

Chicago

DWWWS AND CREATING STATION WE'VE - 268 NETTHE AVIN A the Radio Industry



CUTTER-VERTIER

Samplifies radio toning Penvil report a station on the distthereafter, simply turn the finder to your pepcil mark and you get that station instantly Easy equick to mount. A single various tools gear ratio 30 to 1 Furnished clockwise or anticlockwise in gold or silver finish.

> Silver \$2.50 Gold \$3.50



This seed on a radio product is your assurance of satisfaction and a guar antee of Lacrust design.

Tedious fumbling about for stations is past! Science has been brought into play Now, with the Ultra Lowloss Condenser you can instantly tune in on any station as easy as turning the hands of a clock to the hour

With one station located on the dial, all others can be found instantly. Each degree on a 100 degree dial represents approximately 312 meters difference in wave length, both high and low wave lengths.

The secret of the new simplification is the new Cutlass Stator Plates found only in the Ultra-Lowloss Condensers. Overcomes losses common in other condensers. Designed by R. E. Lacault, originator of the famous Ultradyne Receivers and Ultra-Vernier Tuning Controls.

At your dealers, otherwise send purchase price and you will be supplied postpaid.

Design of lawioss coils furnished with each condenser for amateur and broadcast wavelengths showing which will function most of ficiently with condenser.

PHENIX RADIO CORPORATION 114-A East 25th St., New York

• CLITRA-LOWLOSS

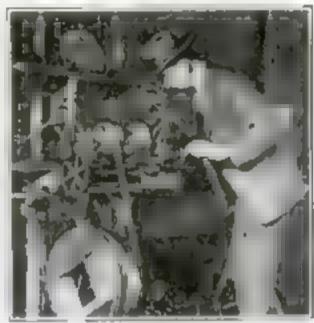
CONDENSER

Minist 10/0 PPOPULATS Write recret bettern with invisite The bals posts filme to Bould from a glass and Bayes Collapsible male a ber of contra Bungk Hand blank aftetang at es) ar ire h to the state of th of henousy OOP AERIALS Popular Prices -- Remarkable Results No herter loops at any price Quant y prostuction bound trives live Handson: convenient and efficient For any setemploying pulso frequency smplification. For extrain Superficts in social a center top. If your drafer capital supply you, under direct giving your dealer stopic. Write for Bustrated catalog Fo. CHEMICAL CO. 15 Washington St. 1 1514 51 LINCOLN RADIO CORPORATION, 224 M. Walls St., Chicago

Druggist Builds Machine Tools for Amusement

WHAT can be done by the home worker who has had no special mechanical training is well illustrated in the work of B. L. Kemper, a druggist of Perham, Minn., who long has been a reader of POPULAR SCIENCE MONTHLY

As a boy Mr. Kemper wanted to be a machinus, but never had a chance to become one, as there were no manu-

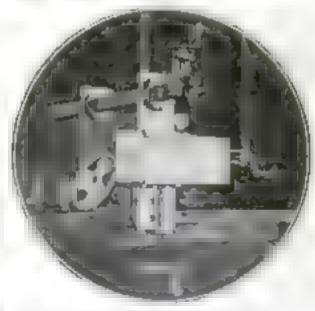


B. L. Kemper of Perhant Minn, working at the lether in his amail but well equipped when

facturing industries in his home town He found his way early into the drug business and, being successful, has remained there ever since

In his bours of lessure, Mr. Kemper turned naturally to mechanical work as a hobby. He has built up such a splendidly equipped small workshop that the Editor asked him to tell something about the secrets of his success. He writes as follows.

I have made it a point never to burrow a tool I could afford to buy. In
that way I gradually accumulated quite
a nice collection of small tools. The
more tools I acquired, the more I eajoyed using them, and the more I used
them, the more I wanted. The money
I put into my tathe and electric motor,
of course, required a real affort, but
otherwise the investments in my shop
did not hurt much, as I bought a tool
only when I needed it.



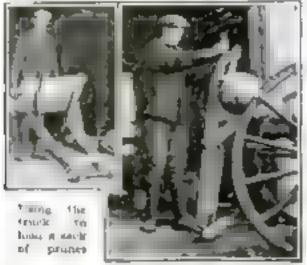
A heach shaper Mr Kentper is building from plans published in Popular Screece Monthly (Continued on page 109)

Lie La Werdselle

Special Truck Lessens Labor of Lifting Heavy Sacks

HAVING loaded many 4-ton trucks with well filled sacks of prunes, I felt the need of some labor-saving device to aid in lifting the sacks. The result was the construction of the simple truck illustrated.

Thin is laid flat on the floor while the anck is tipped on it. Then it is raised by



the handles and wheeled to the storehouse door. Here the wheels strike a wooden stop nailed to the floor directly behind the truck. As it comes to a sudden stop, the truck rises to an apright position without any special effort on the part of the operator, so that the sack can be slid directly on the truck. This saves the back-breaking work of lifting the sacks bodily.—J. J. B.

Druggist Builds Machines

(Continued fenm gage 1981)

The things I make are mostly tools and equipment for my shop example, there is a milling attachment for my lathe, which I built myself, the work being done on an 11-in lathe of a make advertised in Populan Science MONTHLY. This is a very handy attachment. The material cost me only about \$2 and I had saveral weeks of real fun in building it. The regular manufactured attachment similar to this one sells for something over \$40 Thus attachment has a dovetail slide that swivels to any angle. Together with the compound rest, cross slide, and longitudinal feed of the lathe, I can get nearly any adjustment I want.

One of the photographs shows a

shaper that was described in the May. 1923 made of Popular Science Month-LY It is still under construction, but I believe it is going to be a ready good machine for its size,

I have made a bandsaw, taps, dies, milling cutters, special lathe centers drill pade, and mills, boring burs, toys for the kids, real steam engines, and the like.

The fun that Mr. Kemper, as well as so many other readers, get out of their home workshops, is within the reach of any one, no matter how little previous experience he may have had in mechanical work.

Simply by reading the Home Workshop Department regularly, any man or boy who is interested in mechanical work can obtain a comprehensive knowledge of correct methods. Work of this kind is both fascinating and profitable.



She hated to tell him

OF late her brother seemed much discouraged. He was being left out of things - dances, dinners and somehow "the girl" never had an open date. His sister knew the cause.

She hated to tell him, because it was such a personal thing.

Nearly all young men are inclined to have a gramy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompenan Massage Cream helps you overcome this handicap by giving you a clean, tuddy complexion.

Clears the Skin: Pompeian Massage Cream thoroughly cleanses the

YOUR DRUGGIST HAS IT

pores. It helps clear up blackheads and pumples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to Use: Rub it in; rub it out. After shaving or washing, rub it in gently. Continue subbing and it rails out, bringing with it all the dirt and skin impurities. Result a clean, healthy skin with clear, glowing color.

Special Introductory Offer 1/3 of 60c jor for 10c.

For 10c we send a special Trial Jar containing one-third of regular 60c contents. Contains sufficient Pomperan Massage Cream to test thoroughly its wonderful benefits. Positively only one jar to a family on this exceptional ofter,

There's nothing Quite 10 effective as doing the job rourself Use Pompezan Massage Cream regularly at home -then you il get the full benefit.



The Pompeian Co., Cleveland, O., Dept.	40
Gendemen: I enclose a dime (10c) for	X
of a 60c jar of Pompeuo Massage Cress	M.

Name.

Address

City State



experts use the

<u>Maydole</u> Hammer

Carpentera, machinists, all men who use hammers to ply their trade usually insist on the Maydole Hammer. They know that it's common sense economy to buy the best.

Whether you need a hammer in your work or 'round the home, garage or farm, it's the tool you use most and hardest. Any way you look at it, it pays to make it a Maydole

The Maydole Hammer is different from ordinary hammers. It's the result of 82 years of experience in making as fine a hammer as human skill can produce. The head is press-forged of selected steel. tempered separately at each end for the particular work it has to do. The handle is of clear, second-growth hickory, air-dried for years; and it's put on to stay. The Maydole has a "hang" unlike any other make of hammer. Take one in your hand and you'll see what we

Ask your dealer for the genume Maydole Hammer.

We have an interesting Handbook "B" on hammers for you, if you'll send us your name and address.

THE DAVID MAYDOLE HAMMER CO.



Me Home Workshop

Unusual Checkerboards Have Attractive Inlaid Borders

HECKERBOARDS always offer a fascinating opportunity for a display of woodworking skill. Although they cost little for material, they are esteemed highly as Christmas gifts. If well

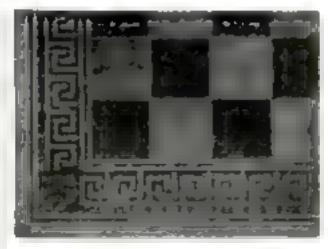


Checkerboard with interesting corner treat ment by William Wess, of Wheeling, W. Va. It is An by 14 by 14 in and able on both aider. The woods are walnut oak guin popor birch cedar sale cherry and malegany

made and carefully finished, they are sure to be treasured for many years.

Making a checkerboard is not nearly as deficult a task as it might appear at first glance. The usual method is to prepare five lengths of walnut or mahogany is by y by 13 in and four lengths of birch or some other hard white wood the same size. These are glued together, the light and dark wood alternating to form a board % by 18 by 18 % in.

When dry, this can be cut across the grain to form eight new strips, each containing nine 1 2-in, squares. These are planed on the edges, preferably with the



Checkerbourd 20% in square. COUNT NUMBER OF 4 51 pieces of wood, paule by J.C Stamon of Richmond. Ottin. The blocks are block walnut and sycamore intertined with beech; the border contains walnut maple therry cease orange pagase and beech The outside edge which is oak also is inleid. The whole is gluid upon a beech betc-

aid of a shooting board and glued together to form a checkerhoard, the odd squares at each end being sawed off

A border then can be prepared and the whole mounted on a %-in.-thick board Another board of the same thickness as screwed on the back with its grain at

Somewood on Just 111.



USKY and dependable—a Luther Vise sticks with you on any tinkering job till it's done. It adds to the fun of doing things with tools and makes hard jobs essy. You acquire downright effection for this work-pal right off the bar!

The Luther has a wider law spread than other vises of the same size, has a larger steel feed screw, an extra-heavy brass feed ser w not, and panelled slate har construction that practically doubles the strength of this important unit Four handy stree-11/3", 2", 21/3", and 3" few spread. Sold by most good l'aidware stores.

Write for free copy of booteler "Tighten Up"

ET THER ORINDER MEG. COMPANY Department A. Milwanken Was.

Also manufacturers of Lucker high quality had grinders







Wooden Clamp Aids in Holding Long, Thin Ceiling Boards

NE man can put up long, thin ceiling boards 12, 16, or even 18 ft. long in awkward places, as under a porch roof, by using one or more clemps made as shown.

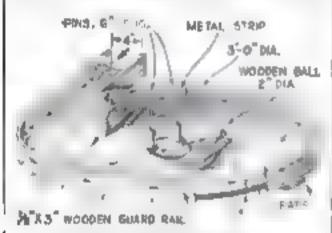


The board to be nailed is held in position for nalling by one or more of the clamps

Each clamp is made of 8 pieces of ceiling or other wood of the same thickness, about 18 in, long. The center piece nerves as a handle and spacer; the other two pieces are arms, which hold the board to be united in place against those already fastened.-GEORGE T. BROKKI

Tri-Pin Game for Children

HILDREN have a whirlwind of fun with the navel tri-pin game illustrated. The player rolls a wooden ball swiftly into the trough no that it travels completely around the guard rail and, passing beyond the end of it, rehounds across the board. A fast, lucky shot, in traveling back and forth across the board, may knock down all the pins. The score, of course, depends upon the



The ball is rolled swiftly into the trough to knock down as many plus on possible

number of pins knocked down in the course of the game, the contestants taking turns in rolling the hall

The playing board is 34 in. thick and 3 ft. in diameter, reinforced underneath with two cleats. The rim and the trough are bordered with a strip of 14 or 3/16 in. basawond, which should be soaked in hot water to make it bend easily.—D. W. C.

Unusual Inlaid Checkerboards

(Continued from page 110)

right angles, so as to resut any tendency to warp

The use of a border gives a chance for originatity in treatment. Inlaid borders are especially attractive and they can be prepared easily by the methods outlined in the article, "Simple Method of Making Inlays for Your Homemade Furniture" (POPULAR SCIENCE MONTHLY, August, page 98+



There's a Real Thrill in trying a New Hook-Up!



Bradleystat -- Perfect Falament Control



Arnalleyleak Perion Grid Leah is no 10 Megohime

Adjustable Resistor

Heymolt Per Fixed Resistor

VERYONE in the family is eagerly waiting to hear the new set. After hours and house of drilling and coldering, the set is mearly ready for its first crucial test. Will it most with your expectations or will

it by a disappointment? That depends upon two things - first your workmanship, and second, the quality of the pare used.

Good workmanship is the result of patience, but good purts are emused only by demanding weil known, guarantind products, such an Allen Bradley Periect Radio Devices Alien-Bradley products are known the world over for exceptional performance and him appointmen. They oliminate the histord and disappointment that follows the use of inferior radio producta.

Ask you dealer for Allea-Bredley Perfect Radio Devices if you visus your time and labor. They always work!



Bradleywer-Perloca



293 Greenfield Ave.



Milwaukee. Wie.



医多性皮肤 医神经性

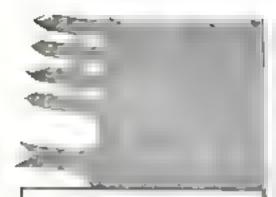
Manufactures of Graphite Disc Rheustata for over 20 Years tiee:

Allen-Bradley Perfect Radio Devices

Atlan-Bradley Co., 21) Geometical Ave. Plants and me your lates Received and the complete Allen Bradies Radio Devices. Mana to sevende terrenessees Address ...



alt Perfect



"ATKINS" Always Saves YOU Time, Labor and Money

IN any tumber country—
on the turn, all over
the world, wherever timber is cut "ATKINS"
ricans the only saw that
is "Segment Ground" to
that easier and faster, the
alv saw made of Same
Steel" to bold it
onger and give added
ervice and value

Remember — II

ric, labor and money I

Luv an VIKINS Silver

Steel Segment Ground

Cross Cut Saw a gray

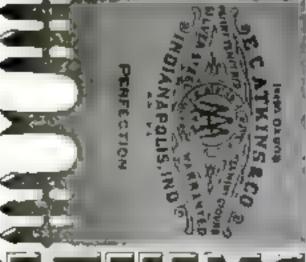
you can depend upon

It will pay you to learn the NULL NO

Ask YOUR Hardware Dear for genome ATKINS No.

E. C. ATKINS & CO.

L Name Trans.





How to Hang Storm Sash

(Continued from page 49)

sill, and the other one giving the width.

If more than two sash are to be hung, it is worth while to make a planing "jack" to hold them. An old board from 6 to 10 in. wide, and from 8 to 10 ft. long can be converted quickly into a jack as shown. If no jack is used, the sash may be placed against the porch steps for planing.

The sides of the mash are fitted first If 3/16 in, or more must be removed from each side, cut off the surplus wood with a ripsaw. Stand the such in the frame to check the width and then place it in the jack and plane each side as required. Fit one side at a time. Bevel each edge slightly toward the inside and allow at least 1/16-in clearance.

When the sides are fitted, stand the sash in the opening and with a block that will reach just above the bottom of the lower rail, gage a pencil line by sliding the block and pencil along



Hooks and eyes or ventileling festeners are

the sill. With the same block, mark the bevel on both edges to correspond with the slant of the sill. Saw off the bottom to the proper bevel. Crates or boxes will support the sash for sawing if you have no sawhorses.

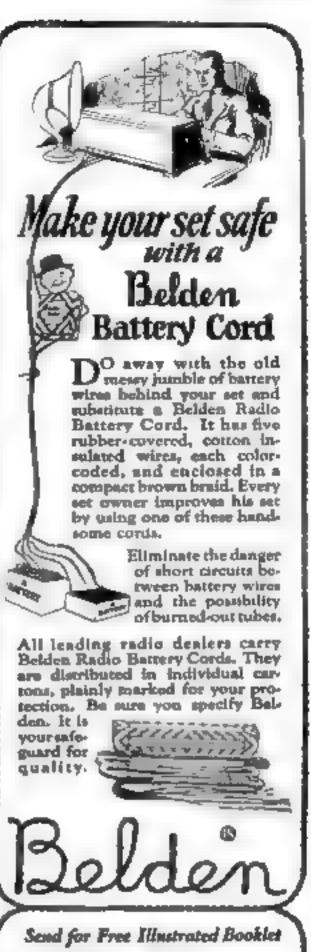
Again stand the eash on the sill and mark the length. Saw off the top and, if necessary, remove more wood by planing until the eash fits properly.

Screens and storm such are suspended from the same hangers. If the hangers are not attached already, screw them on the frame directly above the middle of each such stile or side piece. The such then is forced slightly against the top of the frame by inserting a chirel or thin wedge beneath the bottom rail. Fasten the eyes in place, using an awl or an automatic drill for starting the acrews.

One or two 2 rin. screw hooks and eyes will hold the sash securely at the bottom, but a fastener such as shown above is better in that it permits ventilation, if the storm such, as often happens, has no ventilator in the lower rail.

On fixed windows, such as stair lights and door side-lights, the storm such are held in place with small metal buttons.

The simplest method of numbering storm ask and screens is to mark them with Roman numerals cut with a 14- or 1-m. chusel. Start at one corner of the building and number them consecutively to the right or left. A few of the screen rabbets may be marked to correspond to give a key to the scheme of numbering, in case the order is forgotten. If preferred, nails with numbered heads may be used



Belden Manufacturing Company, 2304-P So. Western Ave., Chicago.

Please cond me your latest illustrated booklet, free, describing Belden Radia Products and their use in radio work.

Name

444





FREE RADIO CATALOG & OLDOE of neutral ideas, Shows as the ideas of special book-ups with illustrations, Shows as the objects of the little parts, sets kits, Berger of set this smooth book before you buy. Wander-full Tracked You heavy so. We refer to the NOW BARAWIN CO., 183-1225. Commiss. CHICAGO, U. S. A.

The Home Workshop

How to Make Best Use of Glue

(Continued from page 7-8)

filled with water and heated over a gasburner or stove. There are more expensive pots heated by electricity

Good bristle glue brushes with brass ferrules cost from 60 cents to \$1 each, according to size. The darry type of thermometer costs about \$1. Carriagemakers' from clamps and carpenters' hand acrews cost from 40 cents up.

The various utensils used with glue should be cleaned execulty and frequently with boiling water. Small amounts of spoiled glue remaining in the glue-pot or on the brushes greatly weaken and sometimes ruin fresh glue.

When liquid glues are set aside after use, the containers should be closed tightly. If through evaporation the glue becomes too thick, dilute it slightly with clean, warm water. Do not use vinegar

Ground, flake and sheet glues should be kept in a clean, dry place, preferably in a tightly covered container of some

In preparing dry animal glues, the glue should be soaked until soft in clean, cold water. It always about dhe stirred into the water to insure complete soaking. Sheet glues should be



Liquid give should flow freely from a stick or brush to apread maily

at least 12 hours; finks gives, from 4 to 9 hours, according to thickness of the finkes; and ground gives from 2 to 4 hours. It is advisable to let them all soak overnight or prepare them in the morning if they are to be used during the evening.

The amount of water depends upon the grade of glue. The water-taking quality of hide glues varies from 1 ½ to 3 parts of water to 1 part of glue. Medium grade hide glues take 2 ½ parts of water to 1 part glue by weight. While bone glues are not recommended for wood jointing, sometimes they are used and they take only from 1 to 1 ½ parts of water.

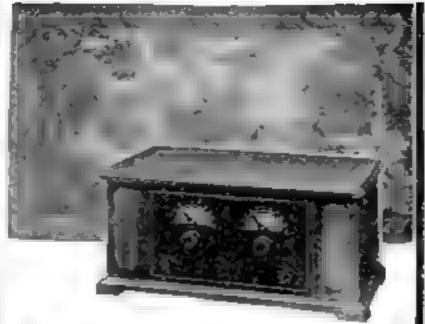
Both hide and bone glues have a wide range of grades, but it pays to use the best glue obtainable.

It always is best to weigh the glue and water each time after the right proportion has been determined. Glue cannot be prepared by guesswork. Animal glue should not be too thick. It is necessary for glue to penetrate into the articles to be glued in order to bind them together if too thick, it jeds on the surface.

A pair of scales were not mentioned in the list of equipment as they are expensive. The local store usually will allow you to weigh your glue.

After scaking, the glue should be dissolved in the glue-pot. If the scaking is complete, the glue will meit readily. If all the water has not been absorbed, leave it with the glue in the pot. Be sure there is water in the jacket of the pot.

(Continued on sout 114)



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The Grimes radio is the supreme achievement of the world-famed Engineer, David Grimes. These are sharply selective sets that tune in the stations you desire, and hold out all others. Distant or local programs are sustained with marvelous clearness and superb tone, just as they are broadcasted, without annoying interference.

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You've expected something new—something that would give real pleasure—by all means hear these sets!

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RADIOS I msca disphragm that eliminates distortion.



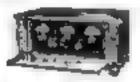
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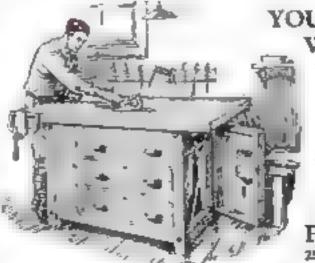
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KNOCK HIS BLOCK OFF!

Ving wragled has a margar and happing main. If you eye up a state to Ke with the death off and the stude of the high that a state on a set was \$50,1 keV.

A stall count a period of all pursual PHS to the

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bearing a service of the

444

The Home Workshop

How to Make Best Use of Glue

(Continued from page 113)

Piace the thermometer in the glue and be sure the temperature does not rise above 150° F. Glue does not have to be "cooked" to make it stacky. Heat is simply to dissolve it and to keep it liquid. When the temperature rises above 160° F., glue rapidly loses strength and if this temperature is continued for some time, the glue is ruined.

Casein glues of good grade usually are prepared by stirring rapidly 1 part of glue into 2 parts of cold water by weight. Continued mixing is required until all lumps are broken up. The mixture should stand from 15 to 30 minutes. for the completion of the chemical action. Only enough glue for the day should be mixed, as these gives become solid like a piece of cheese after about 12 hours.

The preparation of the articles to be glued is important, especially if wood-



Brush the glue on vigorously and be sure to cover well all parts of the joint

The joint should be clean and dry. No wood that has not been thoroughly kiln dried should be used with either animal or fish glues. Wood not thoroughly dried can be glued with casein glue.

The wood should be jointed perfectly before applying glue. Uniform contact between the two pieces must be assured,

When repairing furniture and other articles that have been glued previously. scrape away all old glue and have the joints perfect again before gluing.

In cold weather it always is well to have the parts warm before applying the glue. Animal glue sets quickly and if it jells before the wood comes together firmly, the joint is worthless. When the wood is warm, it retards the "set" and gives the glue a chance to penetrate.

When prepared liquid glue is applied to a joint, it is quite possible to obtain good results by giving one cost of glue to the parts and pressing them together immediately This is the common way of using liquid glue, but it is not the best way. A little additional pains will insure a very much stronger joint.

First apply a thin coat of liquid glue and allow it to penetrate into the wood. It is not necessary to thin or dilute the glue: simply brush it out thinly. Then apply a second coating and allow the glue to become "tacky" to the finger before pressing the joint together and tightening the clamps, hand screws, wedges, or whatever means of pressure is to be used.

(Continued on page 115)

Workshop Workshop

How to Make Best Use of Glue

(Continued from some 114)



in using band screen, beep the jown parallet with the wood and use moderate pressure

Liquid glue should not be heated except in cold weather when it has become chilled and is too thick. If the glue then is warmed or heated to a temperature not exceeding from 100 to 120 deg. F , it is in no way injured. It is a common custom when liquid glue is purchased in a can to place the container with the chilled glue in a pan of hot water. It soon becomes liquid enough to apply on any material.

When hot unimal glue is used, coat the wood freely on both sides of the joint, press the parts together, and clamp im-

mediately

When glued wood is placed in the clamps or presses and these are set up. the surface glue is squeezed into the wood as well as out to the surface of the joint If the proper pressure is applied, the surplus give is eliminated—that is, the surplus that is not pressed into the grain of the wood. When a joint is broken, no surplus glue should appear on the broken parts. The glue should be forced entirely into the wood or squeezed out.

Casein glues should be applied to both sides of the joint and clamped. Plenty of time can be taken to do this, as these glues set slowly. It is well to wipe off whatever surplus glue is squeezed out in clamping, as casein glue dries like flint.

In setting up wood in the clamps or hand acrews, only enough pressure should be used to bring the two pieces firmly together. Too much pressure squeezes most of the glue out. The wood should be allowed to remain in the clamps 24 hours in a dry place.

There are many other purposes for which glue can be used in the home work shou, such as for sixing different materials to give them body and also to cover a surface so other materials to be applied will not penetrate Much liquid glue also is used in the preparation of plantic art clays.

The suggestions given here have been proved by many years of technical and practical experience. If good glues and materials are used, success is certain.

Experienced woodwarkers will note that Mr. Spencer has made no reference. to the so-balled "rubbed" joints. The omesion is intentional. He believes that the method is contrary to all the rules of good gluing and should not be Drac'rred.



POPULAR MEETING





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Kitchen "Safe" Converted into Clothes-Locker

By J. T. Garrer

SOME indication of what can be done by the home worker in remodeling and reclaiming old furniture is given by the accompanying illustrations.

In this metance a wardrobe was needed

badly and an old kitchen "safe," which had been relegated to the cellar long before, was made to serve. The old doors were taken off and new frames of 3, by 114 in. stock were grooved to take panels of fiber wallboard. joints at the corners were mortised

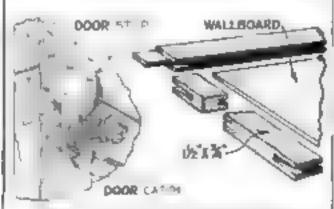




This nest, well finished wardrobe does not betray its migis in an old hitchen cuphosed

and tenoned and each was fastened with glue and two screws.

The top apring latch and catch were made of heavy sheet iron, as detailed, and a hook and screweys were used at the bottom. The hardware is of brase-butt hinges, trunk-lock, drawer pulls, and casters. Brass books for the cost hangers were screwed into the top and two brais



Details showing the method of making the new doors and the homemade door eatch

telescopic curtain rods with eyes at the ends were bent and screwed in place for trousers hangers. The perforated ends of the case were replaced with wallboard.

(Continued on page 117)



And then he got a story in the Post

H18 wife knew he could write, but sumphow he had always lacked the confidence or initiative to try.

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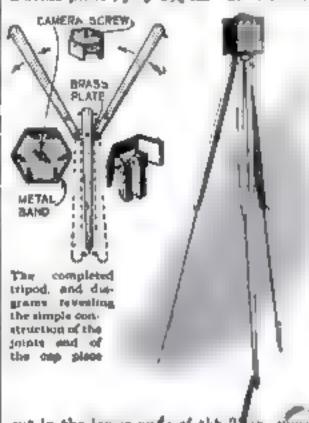
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gost to you.

Tripod for Hand Camera Made from Hardwood Strips

AMATEUR photographers who wish occasionally to use a tripod can make one at a trifling cost. Maple or any strong wood may be used. Six pieces 34 in, square and 27 in, long, with the corners slightly rounded, are required, as well as three pieces 30 in. long. The latter are tapered and fitted with a bram cane ferrule and a headless spike in the end that is to grip the ground.

A slot is out through each of these 30in, sticks 4 in, from the upper end to take a brass plate 14 by 1% in. Slots also are



cut in the lower ends of the 21 in these # then of month of a fram plant forming a bringel joint is in the reserved through the cach the lower legs are rigag a corresponding how in the appear I seems when the thought seet at

The tripen, cap is a becageous black that thick with sides measuring 1th in. It is covered was a price of galvantzed in a bent as shown and drided to receive the are given that are much to faster the lags to the cap. A nut is set into the word, on the under side of the cap to take a .stove holt, which was serew into the tupped hole to be found to a kodak MRS. RUTH D SECLTIS

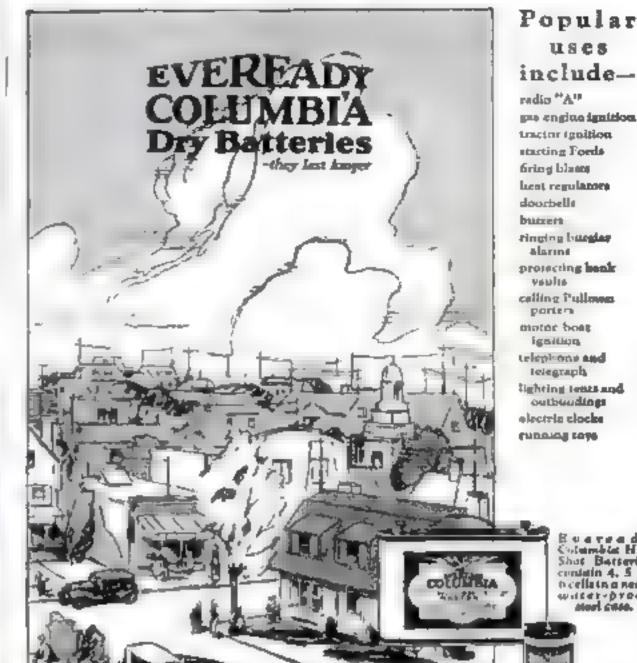
Commodious Clothes Locker

... The Mires from Dage 140]

After the old finish had been remove and all the wooden surfaces had been we sanded, the locker was given a coat . ! flat black. Then the cracks and holes were puttied and a final coat of flat blue. completed the work.

As old kitchen safes of this type often were made of a good grade of oak, a piece remodeled in this way usually may be finished with stain, filler, and from two to four coats of flat varnish, if preferred. It also might be finished with tinted ensmel or wood lacquer. Some such old pieces. indeed, could be made into excellent china cabinets if sufficient pains were taken with the remodeling and refinishing.

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PLASTER of Paris, which has many uses in the home workshop, may be hardened and toughened by mining it with a diluted glue solution instead of water. The mixture also sets more slowly, which is sometimes an advantage.

Plaster casts can be made more or less weatherproof by painting with three or four coats of linseed oil, each coat being allowed to dry before the next is applied. Small casts can be placed for an hour or two in a pan of linseed oil, the oil being heated to fust below the boiling point,

Plaster also may be colored. The pigments used are the salts of the metals, lead, copper, and iron, either alone or in combination. The plaster is mixed very thoroughly with a watery solution of the salt, and then a little formaldehyde in added to fix the color. A preliminary experiment on a small scale should be made first to determine the proportion of saits needed to color the plaster to the right shade and with the desired Intensity.

If you never have experimented with plaster and wish to learn what interesting



Hardening a plantur-of-Paris mut of the foot of "Lagopus," on Alpine ptermigan

things can be done with it, get some plast c wax, such as is sold for children's use in toy stores, and model a medallion with your init ais or any design you please.

Color a small quantity of water with a trace of boung and aprinkle plaster of Paris into it until it is the consistency of thin cream. Pour this over the wax to make a thin layer and, when it sets, brush soapy water over it. Then mix uncolored plaster and pour it over the colored layer until the mold is 👫 in, thick or more.

After the mold is hard, turn it over pack out the wax, give the inside a coat of soapy water, and pour plaster into it. Insert a loop of wire in the plaster to provide means for hanging the finished pinque

When the plaster has hardened thoroughly, split off the mold with an old chisel. or screwdriver down as far as the blue layer. and then proceed very cautiously to chip off the colored coating. This will expose the surface of the plaster medallion, which will be a perfect reproduction of the original wax,

The plaster may be bronzed and then toned with brown, green, and blue artist's oil colors put on in dabs, blended, and partly rubbed off .- ERNEST BADS, Ph D.

W Home Workshop

How to Frame a Dormer

(Continued from page 74)

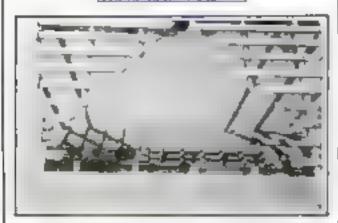


Fig. 1. The first step is to remove the ship gies and cut out the rafters and shoothing

and nails driven into the edges with the points or the edges of the heads inclined downward act as claws to group the roof

Pull all shingle nails from the sheathing to avoid touching them with the saw Two inches outside the wall line, saw off, with a vertical cut, all rafters on the width of the gable. The top of the lower window trimmer (Fig. 4) is 2 in. above this height, and the bottom of the upper trimmer is 2 ft, 5 in above the lower trimmer, so that, sllowing a 2-in notch in the rafter where it meets the side trimmer, the upper side of the rafter is 2 ft. 11 in, above the line of cutting of the main roof rafters. This allows for windows 2 ft. high

The dormer plates notch into the rafters 1 in., rising 18 in. from the base. Therefore, the sheathing must be cut (as in Fig. 2) at right ungles with the base line to a point 18 in. above it, where the valley cuts obliquely to the ridge

point of the dormer

The general construction of the dormer end of the room is shown in Fig 4. The side wall plates bear against the under edges of the rafters, as they do in the plain wall described in the second article of the series last month; but the regular stude that is, those spaced 16 in. from

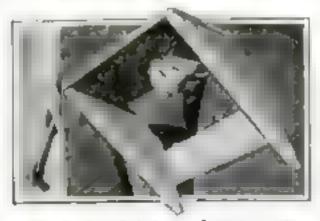


Fig. J. A roof jack is of great assistence in working on a chingled roof

center to center-rise to the dermer plate as at A. Fig. 4, and the side trimmera (B), to insure rigidity, rise from the floor plates regardless of their position between the regular stude. They are notched around the rafters, as shown in Fig. 9

Figuring for a mullion frame for 2-ft. easement windows, with a 4-in mullion, the aide trammers should be 4 ft. 7 in. apart

Figures 5 to 11 illustrate the method of

(Continued on base 120)

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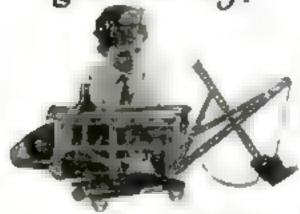
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ta \$50.00. A. C. GILBERT CO., Dept. P.I. 112 Statebley Ave., New Haven, Coop. Please send your free bonk, "1,000 toys in 1" and also the Gübertscape to the following address. Name Street City State

How to Frame a Dormer (Continued from page 118)

laying out the rafters. The projection of the roof beyond the side plates should equal that of the main roof. Lay out the top cut as in Fig. 5, using 12 in. on the blade and 9 in. (or whatever value the rise per foot may be) on the tongue of your steel square, and step along the stick with this hypotenuse as many times as there are feet in half the width of the dormer (See Fig. 11). Lay out for the

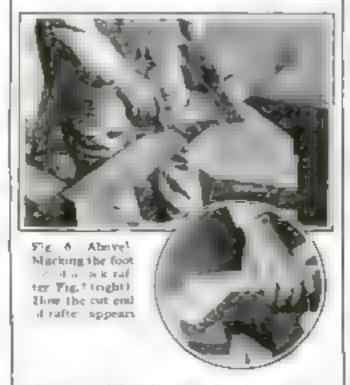


Fig. 5. Laying out the top cut on one of the two dormer reflers with a steel equery

plate notch 1 in, deep, and give the necessary foot projection. Cut the rafter and use it as a pattern for its mate

Tack the two together at top, rest the notches on the plates, and scribe for the trammer notches. These cut, nail the rafters in place, level to the main roof for the ridge point, and saw off the sheathing with vertical cuts, as in Fig. 2, afterward cutting off the rafters as well with vertical cuts 1 in, back from the aheathing so that the latter will have a bearing on the valley rafter.

Valley rafters are laid out like common raiters, except that 17 is substituted for 12 on the blade of the square, since valleys make angles of 45 degrees with the walts and, therefore, must be longer The ends where they meet with each



other, or with rafters or headers, are cut like jack-rafter feet, using 17 for the 12 Nail the valley rafters in place and sail down the loose sheatheng ends.

Plumb the gable rafters and measure 2 ft. from them to the valleys, parallel with the plates, to locate the jack rafters, which successively diminish in

(Continued on page 121)



Here's an indestructible device, costing nothing to operate, but positively soming 20% (often more) of your coal bill. Use less fuel-get much more heat with the

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Fuel Saver & Smoke Abater

It burns smoke by mixing a supply of red hot air (oxygen) with the gases over the fuel bed. Cheaper grades of fuel can be used; excellent results obtained Simply installed on furnace door without damaging it Successfully used for 10 years on every type dwelling and industrial building.

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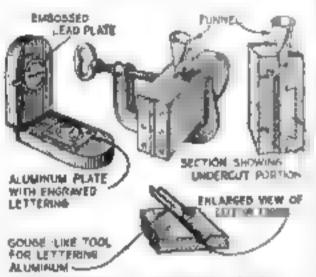
TODIE WORKShop

Simple Embosser for Stamping Your Initials on Paper

AN EMBOSSER for stamping your unitials or other lettering on paper may be made from materials available in

almost any home workshop.

Two 14-in, blocks of pine are hinged together as shown. On a thin plate of aluminum the initial or other lettering is marked out carefully and then engraved by means of any sharp tool such as a miniature gouge made from an umbrella rib or even the point of a sharp knife. A free and informal style of letter will give better results than one that is stiffly



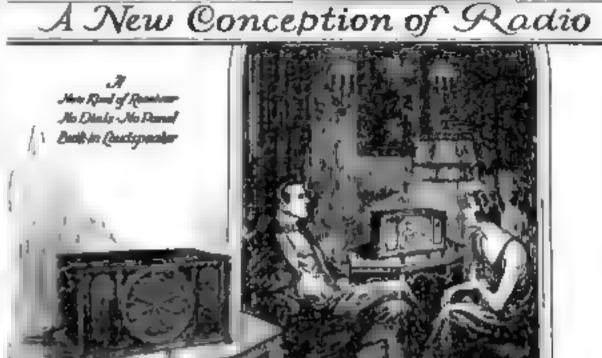
The embount is made by cutting an aluminum dis and molding a corresponding lead punch

mechanical. However, a machine-stamped name plate can be used if preferred.

The finished plate is inserted in a suitable countermunk space in one of the blocks and held with screws. The block opposite is chiseled out and undercut as shown and a small opening is made to permit molten lead to be poured into the block after the pair has been fastened tightly together with a clamp.

After the lead has cooled and been trimmed where necessary, it will be found that a faithful reproduction of the original engraving can be obtained by inserting a sheet of paper between the blocks and striking the upper one a

sharp blow. - L. K. WRIGHT



Tastefully Unobtrusive

This new kind of radio-musical instrument marks the complete mastery of technicalities to the point where the whole range of radio's resources are literally at your instant command.

The Ultradyne, Model L-3, supplants the usual "laboratory machine." It is a new artistic table-piece that makes the entrance of radio into the well-appointed home unobienswe, inconspicuous. It represents the triumph of art over mere mechanics.

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FREE BOOK

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Photographic Print-Washer Cheaply Built of Wood

By J. G. Pratt.

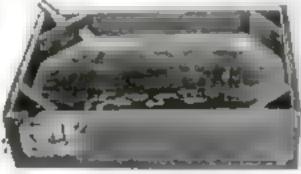
Scientific Photographer, U.S. Department of Agriculture

THE homemade photographic mint-washer illustrated not only is easy to make at little or no cost, but it works on accentific principles and is an efficient as expensive commercial washers.

It can be made any mue to fit one's sink and to accommodate the volume of work required. The one shown is 24 in, long. 17 in. wide, and 6 in. deep merely a large, shallow box put together with brans screws or galvanized nails.

Boards are mitered to fit across the corners, as indicated. The water comes in at one corner through a hose from the faucet. The corner boards give the water a circular movement, which, even at very low premure, is sufficient to keep all the prints in motion

The outlet is cut in the farther and of the fourth corner board, so that as the



The prints are kept in motion and washed thoroughly by the circulation of the water

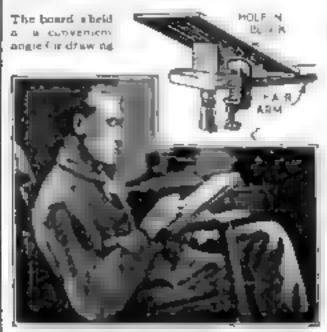
water passes around there will be no tendency for the prints to be sucked into the putiet in order to show clearly the general scheme of circulation, however, this opening is indicated on the photograph as in the near corner

Being low down, the outlet noon clears the tank of hypo, which settles to the bottom. An outlet is cut in the outside of the tank to allow the overflow to drain into the sink. This outlet should be large enough to take care of the water at considerable pressure and placed so as to

water from rising higher than

Triangular Block on Chair Arm Supports Drawing-Board

SMALL drawing-hoard may be supported on the arm of a chair in a convenient position for either writing or aketching by the use of a triangular block clamped to the arm, as shown. The

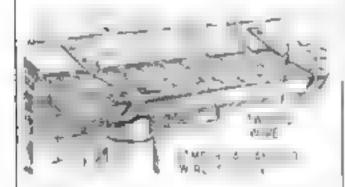


wedge-shaped block is cut from a "two by four." A hole is bored in one side to receive the upper arm of a C-clamp. The drawing-board may be fastened permanently to the block or merely rented against it .- CLYDE E. VOLKERS.

Repairing Pails that Leak

IN NEARLY all cases the bottom of a leaky water pail rusts out while the nides are nearly as good as new. Instead of soldering over the boles, cut a new bottom from a sheet of galvanized iron and drop it in place over the old bottom. Tilt the pail alightly and use a hot iron to solder around the joint. This makes a neat and permanent repair.-J. J. B.

Strips of Wire Mesh Prevent Gutters from Choking



"HE choking of guttern aften results in an overflow of water that wets the walls and sometimes damages the wall paper inside a house. A practical method to prevent the eaves trough from filling and clogging is illustrated above. Strips of 14-in, mesh galvanized wire are placed in the upper part of the trough, flush with the top, and fastened with twated wires to the gutter fasteners.

The leaves and trash washed down the roof are caught on the screen and afterward dry out and blow away. In locations where cleaning the trough is difficult. and somewhat risky work, the provision of guarda of this kind is particularly advantageous.

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E PAGE'S GLUE In Bottles and Tubes

Me Home Workshop

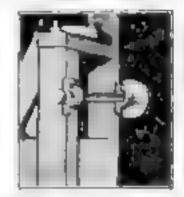
Ordinary Bolt Used to Hold Emery Wheel on Arbor

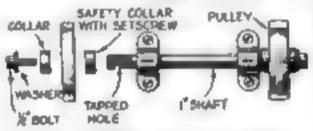
A LATHE or a set of large size threading dies is not essential for making an emery-wheel arbor like that illustrated or, indeed, any light spindle to which a circular saw, buffing wheel, pulley, gear, or sprocket is to be clamped.

The arbor need be nothing more than a piece of shafting of the right size for the bearings that are to be used. A hole is

tapped in each end to take a bolt, which, is the example lilustrated, in 14 in, in diameter

A safety collar is slipped on one end and fastened Next to it is placed the emery





An exceptionally simple method of facturing wheels, pulleys, and gows to small shofts

wheel, pulley, or whatever part is to be used. This is followed by a collar or a number of washers to extend just beyond the end of the shaft. The bolt with this washer then is accowed into the tapped hole until the wheel is clamped tightly. The same method may be used for attaching a pulley to the opposite end of the arbor.—J. B.

How to Finish Cedar Chests

TO MAKE a good coder chest one must know how not to finish it. Recently an amateur craftsman friend showed me a chest upon which he had spered no pains or expense, but it had been spoiled by the application of several coats of hand-rubbed varnish, both outside and inside. This practically killed the coder aroms.

The inside of cedar chests and the aromatic cedar linings of closets should receive no finish at all. If the surface has any objectionable features or the joinery needs concealment, cover the inside with some light fabric fastened with tacks. The outside can be finished with two coats of white sheller applied evenly and thinly, each coat rubbed down with burlap or curled hair.—A. J. H.

Spring Clamp for Glued Joints

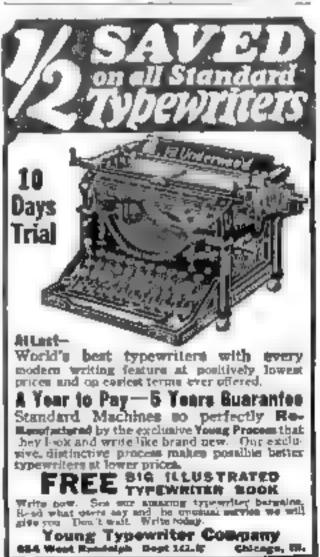


SINGLE turns of spring wire cut from an ordinary bedspring make fine clamps for holding together small glood joints, such as at the corners of picture-frames. One complete coil of the de-

sired dismeter is cut from the spring and sharpened at both ends.—M. E. S.

have you a cold room





Better Shop Methods

Continued from page . 2)

Old Bill Says

GOOD work depends more upon the upon the kind of tools evallable.

Try to select a tool and a method appropriate for the Job in hand; using fine, delicate machinery and light tools for

rough work is never good practice.

Some men use a micrometer as if it were intended for a clamp, Mysympathy is with the "malke."

Make use of every safety device provided in the •hop.

If you have any grouches, leave them at home: the shop is no place for them.



Old Mill, mechineshop foremen

It is better to take plenty of time in grinding a milling cutter than to hurry the Job and perhaps spoil the cutter by burning it.

Fine, hard wheels or heavy cuts are what burn a cutter; very light cuts should be taken and as many cuts as are necessary to clean up all around.

If you think you lack new and better opportunities, the chances are you will miss the one you have right now.

Keep your eyes open and you won't need to ask: "Where's this?" and "Where's that?"

A man can be pulled out of a rut, but he must run on his own power after he is out.

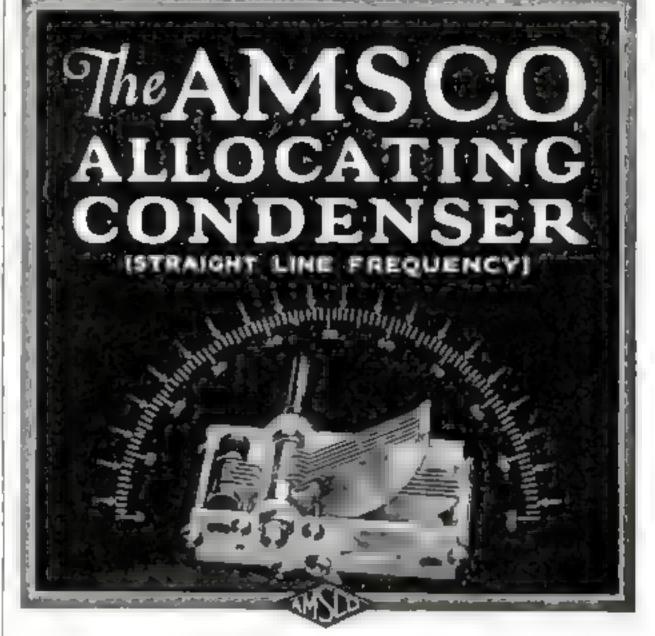
Ensily Detached Stud Driver

STUD driver that can be detached easily from the stud after it is driven home, or after the stud bas been removed from the hole, is illustrated. It is made of hexagon steel of about the size of the nut. A slot is cut at the end of the

tapped hole to take a tapered key, simlar to a drift for removing taper shook drills.

With the key in place the driver is turned on the stud and the stud in driven home. Then the key is knocked out so that the driver is free to turn off locaely.-R. W. CADMAN





Spreads the Stations Over the Dial-The new

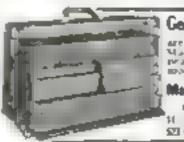
AMSCO Allocating Condenser is the triumphant combination of electrical engineering and machanical ingenuity. Electrically efficient in unacrombling the stations on your dials. Each dial degree from 1 to 100 will be found to represent 10 broadcasting kilocycles accurately over the entire scale-"a station for every degree". Mechanically ingenious in correcting the fault of other B. L. P. Condensers—it conserves space! Belentific Law-loss construction. Rigidity with light weight.

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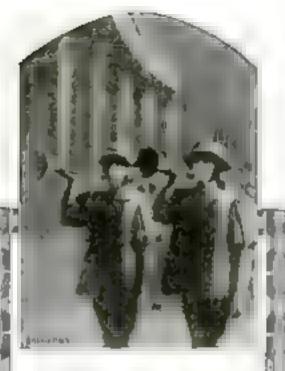
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Trumpets

Timbre of brass and thunder of trombone! Out over mountain and prairie, through storm and sunshine, it is carried on the waves of the air from the steel towers of the broadcast station. And in your home it rings out clear and strong -held fast to all the purity of the original by the marvelous power of Rauland-Lyric.

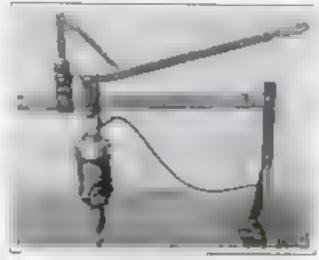


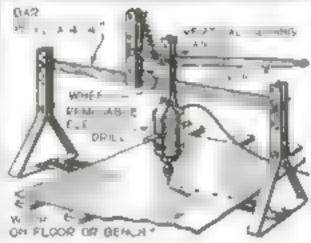
Simply Constructed Frame Aids in Drilling Large Plates

TO ADAPT a portable electric drill for drilling a number of plates with holes 20 in. from the edge, I made a supporting frame as shown below. It would have been exhausting work to have drilled the holes without some support for the drill.

The frame is constructed entirely of t flat bar iron, each piece 14 by 2 in. by 4 it, 4 in. The brackets are drilled with a series of holes for adjusting the beight of the horizontal bar.

The skiding bracket also has boles to allow additional vertical adjustment





How a portable electric drill is supported for drilling holes in large and awkward work

A collapring attached to the sliding bracket and the drill lever in either of the two ways illustrated in of some amistance, as it holds the drill away from the work, except when pressure is applied on the

The hanger for the drill may be made from a single piece of iron bent as shown in the photograph, or of two pieces as indicated in the drawing, depending upon the type of drill that is being used.

The aliding bracket is provided with a steel roller so that it is easy to shift the position of the drill in a horizontal plane.

The general dimensions of the frame may be modified to suit the type of work to be done.-O. W. MIELENZ.

For getting oil into the several oil holes on a lathe that are at an angle and difficult to reach, I use a high-pressure oil gun with a nozzle to fit the boles. Work that cannot be held in a universal chuck, and, because of a flange or projections, in difficult to set up in a fourinwed chuck so the center will run true, can be adjusted easily by truing the outsides of the jaws, provided they are all of the same length.-G. T. S.



Musical

The Hohner Harmonica is endorsed by rausical and educational authorities as the logical instrument with which to encourage children to learn music by playing it. "The Harmonica was the first instrument Lever knew" says lrving Berlin, nationally known composer and music publisher. "It is natural that a healthy youngster should take to the Harmonica, and from the Harmonica It is but a step to another musical instrument and a musical education. It will not surprise me if the Harmonics becomes a most important factor in making America a more musical nation." Ans me can go his tearn to g av a 21 horr flan



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Better Shop Wethods

Semi-Automatic Guide for Ruling Parallel Lines

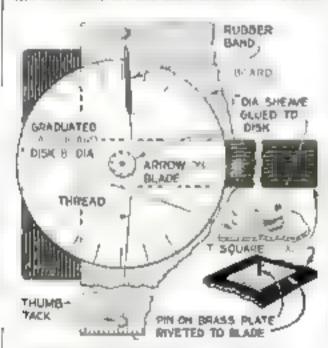
HERE is an easily made device for ruling a large number of parallel lines at equal distances from each other with almost machine-like accuracy. It consists of an 8-in, disk with a 1-in, sheave attached to its center, the disk being pivoted on a blade of a T-aquare.

A cord or thread stretched between ring at the top and bettem of a drawing-



Ruling lines on a special form by mesne of a quickly improvised specing device

hoard is fastened around the sheave, so that a downward movement is transmitted to the T-square by rotating the disk. An arrow is marked on the Tsquare as an index point. Two lines the desired distance apart then are marked on the drawing paper, and, by moving the T-square from one to the other and simultaneously marking two points on the duk, it is determined how far apart the divisions on the disk must be. These

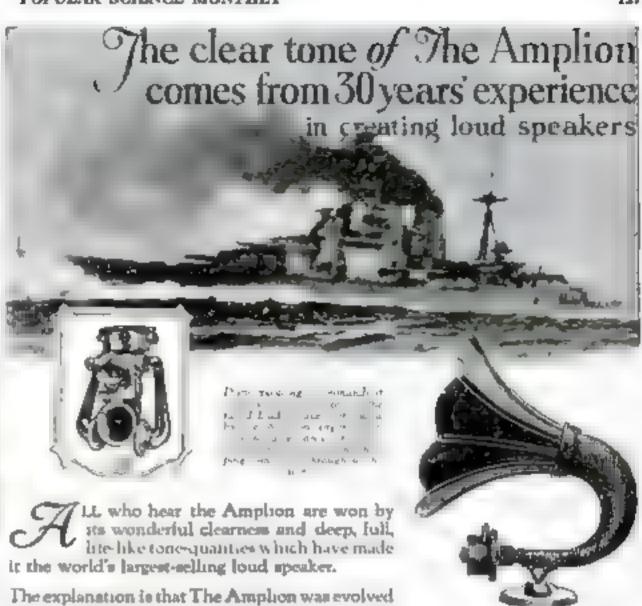


Turning the disk from one mark to another moves the T-square down one spect

then are stepped off around the circumference of the disk.

Any number of abeets can be ruled rapidly thereafter by moving the lefthand edge of the disk downward with a finger of the left hand the distance of one graduation after each line is drawn. Several interchangeable dasks having different graduations may be provided.

ONE of the best lubricants for lathe centers is a compound of white lead and machine oil, mixed to a consistency of a thick paste. It lasts longer than oil.



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JIMMY DE FOREST, Box 714 347 Madison Ava. New York City



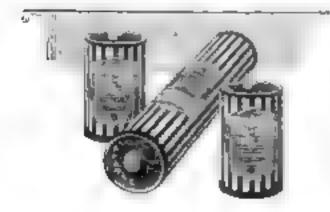
OMETHING to remember is that any good flashlight case practically never wears out. Filled with a Burgess Flashlight Battery, you have done about all that you can to insure yourself against the inconvenience and danger always present in darkness.

Burgess Flashlight Uni-Cels will fit any case you may have. Try them-no better batteries are made.

A Laboratory Product

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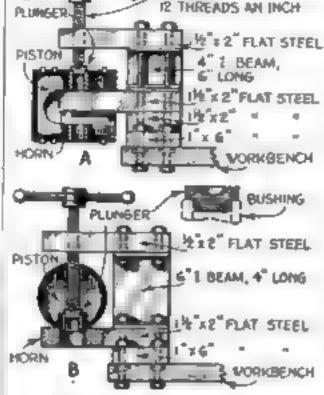


Jigs for Speedily Replacing Weistpin Bushings

GARAGE owners or mechanics who are anxious to cut down the time required to replace worm wristpin bushings will find that the two jigs illustrated are hig time-cavers. They are easy to construct, made from materials readily available, and will prevent the breakage of pertonu.

At A is shown the arrangement med for forcing the new bushing into the pia-

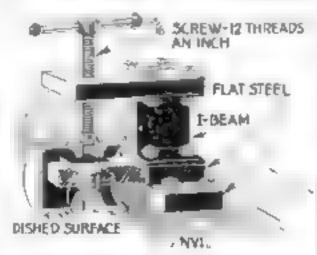
% SCREW



New wristpin bushings are presend in 🖚 at 🗛 and old ones removed so at 🗗

ton, and at B is the other jig for pressing the old bushing out of the piston, which is done from the inside

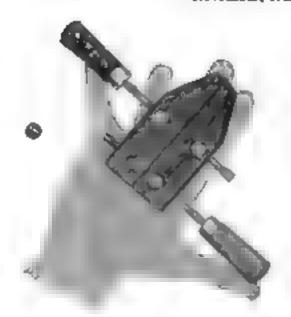
The horn for jig A in flat, and small enough to go into the smallest piston, while the horn for jig B is alightly dished to prevent the piston from slipping when the pressure is applied. A plunger will have to be made for each gian bushing, although the same plunger can be used for preming bushings out and putting the



A suggestion for combining the two jigs, if it is desired to save space

new ones in. They should be made a trifle amaller in both diameters than the bushings.

While the screw is shown as 12 threads to the inch in each case, it may be coarser or finer to suit shop conditions. To save space, the jugs can be combined if thought advisable into a double-purpose device. -FRANK N. COAKLEY,



Something New!

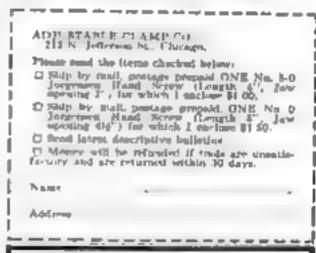
Just what you need in your tool kit

HERE is a handy little clean, no bigger than your hand, to hold radio panels for drilling or sawing, and descens of other jobs that invariably turn up.

The Jorgensen Steel Spindle Hand Screw is far superior to wood-spindle or all-metal champs. The steel threads will not strip, break, or swell when exposed to dampnose. Smooth or polished surfaces are not injured by the oil finished hard maple jaws. The spindles operate in steel swivels, a feature which allows the clamp to grip straight or angular work with equal facility, and when di taker hold if dorr noi let go.

Send for this handy t me and trouble saver today Make your test kit completed If you are not entirely intended, your money will be refusiled theer? By

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The Wender-Working Leties

Use like toilet water. Is positively reccorrespond for quickly and perconantly removing

Pimples, Blackheads, ache

Eruptions on the face or body, Barbers Itch and Ficzema, Enlarged pores, Uniy or Shiny Skin. Endorsed by drugglata, physicians, skin specialists, barture, and ere the util their and witners the crass, who succeeded with their True afterfalling with remything size. Write today for my Free bookies. A CLEAR TONE BKIN." telling how I cured myself after being aftered 15 years. E. S. GIVENS, 155 Chamber Hitz., Emerge City, Ma.

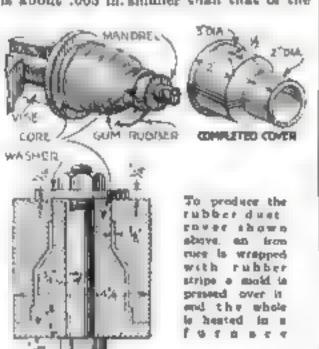


Rubber Dust-Covers Produced in a Machine-Shop

RUBBER articles rarely are produced in a machine-shop, but they can be made, if of a simple nature, with ordinary equipment. In one instance a shop building grinding-machines required a cover to keep water, dust, and dirt from a bearing near the end of the spindle.

Leather was tried without much success and it was decided to use rubber. It was found that a next and satisfactory job could be done. The stunt was another demonstration of how machine-shops can "roll their own" in emergencies.

A mord and core of cast from were made as shown and boited together. The boit hole through the central core was reamed to be a snug fit on a standard mandrel. Where the core comes in contact with the mold at each end the diameter of the core is about .003 in smaller than that of the



mord so that the two pieces go together and come spart freely.

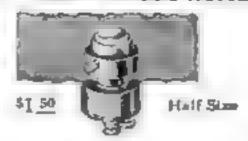
The material used is ordinary gumrubber repair absets 1/16 in. thick and 12 in, square, which are sold by auto-supply houses for repairing tires and tubes, This is cut into strips about 14 in wide. The core and mold are dusted with powdered acapstone and the core is placed on a mandrel in a bench vise. The rubber is wrapped around it, starting from the large and. Two layers are put on as evenly as possible.

Some experimenting was necessary at first to get the right amount of rubber to fill the mold evenly. The material used in each test was weighed on a small postal scale. The third piece came out perfect in shape and of uniform thickness, and it then was easy to duplicate the result by weighing the material each time.

When the rubber is built up in the rough, the mo.d is forced over the core. The core and mold then are removed from the mandrel, bolted together, placed in a furnace, and held at a temperature of 400 deg. for about 20 minutes. They are then removed and cooled in an air blast. Water cannot be used for cooling as it makes the rubber porous. When cool, the core is pressed out, leaving the dust cover in the mold, from which it can be removed by hand.- H L. W.



CARTER New "IMP" Pilot Switch



Elim nates possibilly of going away and so mix tobes burning. Rea light she we all the me tube framents are at complete with matter turn roup switch and light at the Sim is to install. Single hole mainting. Lamp perates on 6 or 412 volts. 15 100th Amp, buttery drain begangible. of the latest Carter radio achievements.

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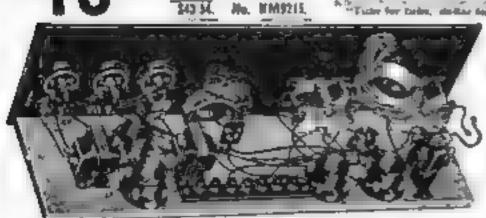
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Learn to Draw in 1 Hour

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Company. Inc. 2317 Eneter St. Lanconnatt Obin



Getting Ahead?

Read the advertisements on Pages 144 to 174 this issue if you want to get ahead!

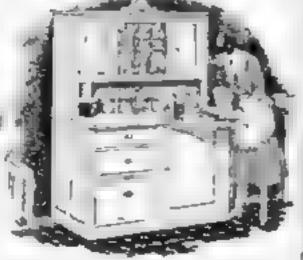
Save \$44.00 on this Beautiful White Enameled Kitchen Cabinet

42.0

THIS handsome white-enameled kitchen cabinet would cost \$65 if bought in a store. If you are handy with tools you can make it at home for \$21-or less. A clear saving of \$44.

One feature of this cabinet is a selfcontained seat. Another attractive leature is the roomy china closet occupying the middle section of the top of the cabinet.

Besides the china cupboard, the top sections contains a flour un and a closet for sugar, spices, and coffee.



The bottom section has one large cupboard and three drawers, the lower one being a metal lined bread and cake container. There are two large boards that pull out.

A blueprint with full instructions for making this beautiful cabinet can be secured by senting 25c to POPULAR SCIENCE MONTHLY

POPULAR SCIENCE MONTHLY, 258 Fourth Avenue, New York

Enclosed is 35c for which please send me your biseprint for a Kitchen Cabonel including all the

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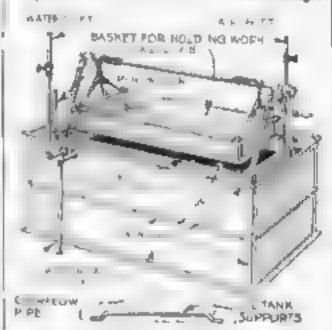
Oil Quenching Bath for High Speed Steel

By H. L. Wheeler

THE oil quenching bath illustrated below is large enough to serve two fusnaces on manufacturing work such as the making of milling cutters, drills, reamers, and other tools. The outer or water tank is 3 by 3 by 8 ft. It is made of heavy calvanized iron reinforced by 14-in, angle from at the corners and around the top and bottom.

The inner tank for the oil is 2 ft. 8 in. by 2 ft. 6 in. by 6 ft. and in of similar construction. It is supported by three pieces of iron, bent as shown and fastened to the bottom of the water tank

For holding the work a basket is made of perforated metal reinforced with angle



The oil, which is in a water jucketed. suh is hept agitated by compressed air

iron and provided with a simple type of lifting apparatus. The brackets that support the shaft are made of M-in. flat trop and are bolted to the top of the off

The shaft rotates in two cast-iron pedestal bearings, which are bolted to the brackets. At one end is a ratchet wheel and pawl to hold the backet suspended while the work is being removed. Two pieces of chain of equal length are fastened to the shaft and connect it with the work basket.

The outer tank is piped to a water main and is connected with a drain. Both inlet and outlet are provided with valves. An air pipe connecting with a compressedair line enters the oil tank at one end and runs diagonally along the bottom, A series of holes drilled along the underheath side of this pipe allows the air to escape for the purpose of keeping the oil agitated so that the bath will remain as nearly uniform in temperature throughout as nosmulb.

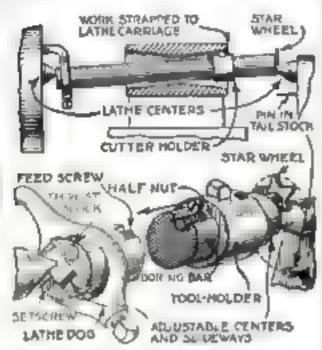
A length of S-in, pape is set into the water tank at one corner and serves as a receptacle for the cold end of the pyro-

When the work begins, the basket is immersed in the oil so that the top is covered. Both the water and air are turned on and the tools, as they are taken from the furnace, are plunged into the

Eccentric Bar Used in Boring Two Tapers at Once

BORING a large shaft coupling with a taper in both ends was accomplished in one shop by departing from the usual method of holding the casting in a chuck. Instead, it was strapped to the carriage of the lethe and the boring was done with a bar, both tapers being cut at the same setting. This insured accurate alinement.

Slots were cut in each and of the shop's sliding-head horing-bar so that an adjustable center could be held with a setscrew in order to provide a center hole eccentric to the axis of the bar. Each end



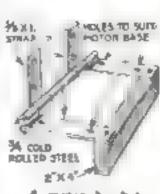
Two tapered holes in exect alinement are cut by the tool as it advences through the casting

of the bar was not the same distance off center, but in opposite directions. One point in the middle ran true, and this located the position of the center of the casting. A pin set in the talastock actuated the star wheel on the end of the feed screw, which engaged a half nut in the boring-head

The tool was traversed from one and of the casting to the other, and, owing to the eccentricity of the bar, it bored a hole progremively smaller until it reached the center of the casting, where the taper reversed, and the tool, continuing to cut, made a hole that became uniformly larger -J. A. HORTON

Hinged Brucket Holds Motor of Small Drill Press

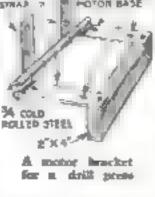
A MOTOR for driving a small % 30. drill press can be mounted eaply and cheaply on a hinged bracket made as Illustrated. This is fastened to the pedestal of the machine so that the motor is well off the floor, where it is out of the way and less liable to



become dirty. A mounting of this type

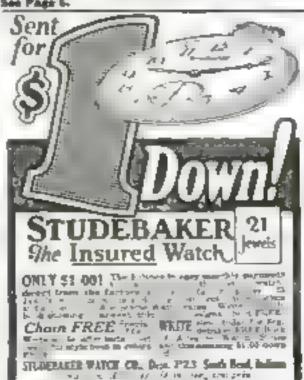
has the additional advantage of keeping

an even tension on the drive belt at all





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BOSTON SPORTING COODS CO.

A pipe-smoker over in Paris grows desperate

Our sister republic excels in many fields of production, but Americans in France seem to retain their preference for their native smoking tobaccos.

That seems to be the case with Mr. Parkhurst. He just happens to to be in one of the few sections of the globe where Edgeworth isn't. In France, tobacco selling is controlled by government monopoly.

With the exception of a few countries, of which France is one, Edgeworth is sold all over the world. And so the chances of getting it wherever you go are about ten to one.

Paris, France

Large & Brother Co., Michigana Va. Centienten

My not papeful of Engeworth went the way of all good tobach is use two weeks ago and since then I have visitly apent thost of my space t me searching Paris for a. fursher emprey

If Edgeworth can be obtained here please let the know where and it can accure you it will publish the slad to not us the little blue can had a same than a new terms of the cover will a sales at a factor of a new terms. poste russ on American his soul to the That the bive of bleaken we re do y a get that Edgeworth II a much to weight be guide asserbers. I become a best and a conse the supply I brought over the out

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B. C. R. Parkhard.

Lat us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the same

EDGEWORTH) P. rs. you II like ever and whenever you buy at, for it never changes in quality Write your name and nudress to Larus & Brother Company, 10K South 21st Street,

Richmond Va.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready Rubbed are packed in small, pocketsize puckages, in handsome humidors holding a pound, and also in several handy in-bet ween sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth Larus & Brother Company will gladly send you prepaid by parcel post a one- or twodozen carton of any mre of Edgeworth Ping Shoe or Edgeworth Ready-Rubbed for the same price you would pay the jobber

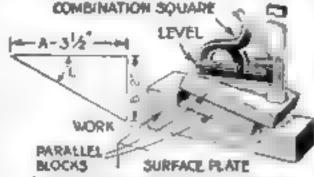


How to Use a Combination Square as a Protractor

IN THE absence of a protractor, the combination square may be used to measure an angle by the application of simple trigonometry.

With the work to be measured on a level surface plate, the scale is adjusted in the head of the square until the bubble is in the center of the glass. Then we have two sides of a right-angle triangle.

Assume that, as in the illustration, the distance A from the scale to the edge of



Measuring an angle with a combination equary and a little elementary shop trig

the head in $3\frac{1}{2}$ in, and that B, the projection of the scale through the head, in 2 in. Then the tangent of the angle L is 2 divided by 814 or .5714. Referring to a table of trigonometrical functions we find that the angle corresponding to that tangent in 29 deg. 45 min. The distance A always will be constant with a given square bead, while B will vary with the

in the example shown in the drawing, it was necessary to use two parallel blocks to bring the angle up, as the space was not large enough to use the square head directly litted Littlequist.

Gas Engine Supplies Shop with Compressed Air

COMPRESSED air, when required in small quantities in a shop, may be obtained from a gas engine, if one is used and if the air does not have to be pure and unburned.

Two nipples, a cut-off valve, and a check valve are the essential parts. Drill a hole in the cylinder head, tap it for a

la-in, pipe, insert a tarin, nipple, and screw on the cutoff valve, another supple, and then the check valve. Next come the connections to the tank, if one is used, or a pipe of large diameter tightly fitted, which will serve as n amall reservoir

If more than a small quantity of

air is to be used, it might be well to fit a small water reservoir around the cut-off and check valves, as illustrated, to prevent overheating. That is essential only when the air is used quite steadily. Pressure in the neighborhood of 100 pounds osually may be obtained in this way.-HIRAM E. BARBER.

CHECK

GAS ENGINE

CYLINDER HEAD

Valves connecting cyl-

icader with air back



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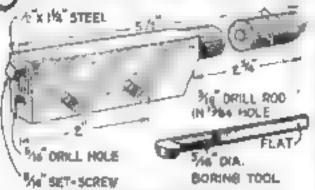
Bener Shor Merhods

November, 1925

Combination Boring-Tool Holder Is Useful for Awkward Work

CEVERAL improvements over narrly made by mechanics for the use are to be found in the tool illustrated

The common method of locking the toolbit is to have a setame in the tool end of the bar, either at the side or the end. This serew cometime interferes with the forkit such an extent that a forget tool is required, especially in very n this hoder, the locking device has been placed at the rear. This is accomgred by drilling a hale longitudinady through the body of the tool and using a



Two types of boring tools can be held to this unusually simple and convenient holder

short length of steel rod to transmit the pressure from the setscrew to the toolbit

Another feature of the tool-holder is the provision made for holding a second tool of smaller size made from drill rod. Thus tool, which is made as needed, has a flat ground on one side to prevent its turning in the holder and is locked by two set-

The body of the tool is a solid piece of 14 by 114 in. tool steel, 516 in. long, from which a section 34 by 234 in. is cut with a hack-saw or in a milling machine, The barrel then is finished in a lathe as shown above

Tools of the same design can be made in larger sizes when required for heavier work -C. G Kneig

Handy Milling Fixture

"HIS fixture is designed for tme on hand-milling machines for holding small shafts and other round work. It saves time on many operations, such as milling keyways, slotting and milling shafts, and similar

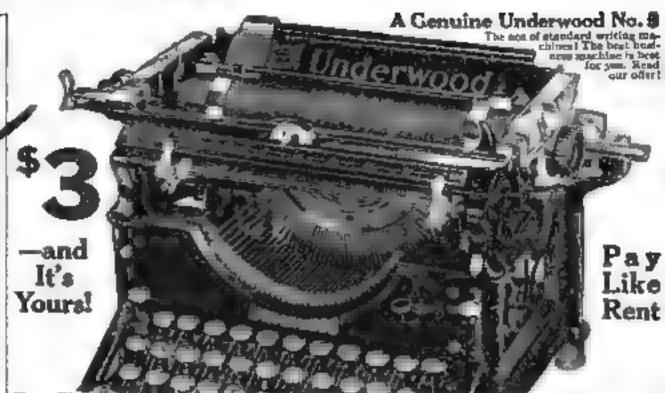
work.

The iron body of the fixture is cast from a simple pattern. A solid key is planed on the bottom to fit the table slots: this should be parallel with the V. The clamping piece is cast with a cored

bole and is made a sliding fit in the guide hole. The screw has a equare end to take either a wrench or a regular visa handle.—H L.



Fixture for holding amail shofts on a milling machine



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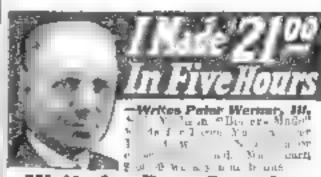
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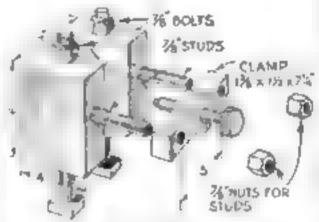
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screw in the clamp is of value in clamping work smaller than the depth of the V .--H. M. CORNWELL.



Details of a heavy V-block for bandhag a under range of cylindrical parts

Shop Racks and Tables

(Continued from page 22)

"We can get in the habit of keeping the tools where they belong. I can get some boards built behind the lather to hold the chucks and codets. We can make some sort of benches to go by each drill press, so that we can keep the V-blocks and angle krons off the floor."

"You could paint numbers on the machines," Mr. Jackson suggested, "and number the tools that belong to each machine, so that even a new man will have no trouble in putting things back where they belong."

The Joreman nodded approval.

KEEPING taps and the a block is a with them together in a block is a EEPING tage and the drille that go mighty good plan, I think," Black said "Now in this job that I fell down on I had to go one place to find a tap and another to find the drills to use. I know that we have a counterbore for a onequarter-inch screw head, but I could not find it this morning. If they were all kept together, it would save a lot of Lynne."

Out of the distance came the far-away sound of a factory whistle. Soon the shop's whistle would blow likewise. The group rose to go into the shop, every man with a fuller understanding of what is one of the main problems of management—having things where they ought to be when they are needed; and each had a keener appreciation of the part he most play in the game of getting the shop work out on time and in good shape-n really fascinating game to those who play it right.

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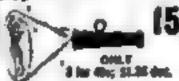
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Simple Fixture Saves Time in Drilling Holes Accurately

DETERMINED to reduce the time required to drill holes accurately by the button method, one shop developed the tools shown in Fig. 1. Their application is illustrated in Fig. 2.

The steel block has a hale at one end to take a plug with an accurate center, or any one of several drill husbangs. In drilling a die or jig plate, the holes are laid off on



Fig. 1. The drilling block, the plug used for to are it and one of the drill bushings

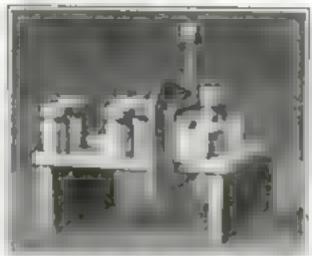


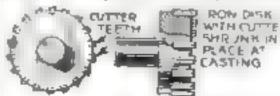
Fig. 2. After the black has been located properly a mitable deill bushing is inserted

the plate with the aid of a height gage and carefully center punched. The marks may be checked with a magnifying-glass for very accurate work,

The block is placed on the plate with the hole over one of the center punch marks. The pointed plug is put in the hole so that the point is in the center mark. While in this position the block is clamped rigidly. The plug then is removed and a bushing is inserted to guide the drill that is to be used.—C. K.

Cheaply Made Milling Cutter Has Teeth Cast in Head

SMALL shop owners and foremen often hesitate to make a new milling cutter because of the time required and the cost. A quick and chesp method of



Steel cutters are placed in the core prints in the mold before the head so east

making a good cutter without the usual difficult machine work is illustrated

A plain disk pattern of the size required is made for the head, Core prints of a size to suit the cutters to be used are located around the circum-Jerence of the pattern. When the bead has been rammed up in the sand, the self-hardening steel cutters are placed in the core prints in the mold, just as a pore would be placed in regular work.

It is advisable to dip the cutters in oil before inserting them in the mold. That is done to clean off all dust and to insure the troo's adhering to the cutters.

The casting is removed from the sand as soon as possible after the fron has been poured and allowed to cool in the air. The iron shrinks around the cutters, holding them very securely.

This process softens the self hurdening steel to a small extent, but no difficulty will be found in heating the cutters in the ordinary way and cooling in an air blast to being back the needed degree of hardening

The cutter head is machined to suit the arbor and the cutters are ground to the required shape.-F C

Steel Ball and Setscrew Hold Tool in Boring-Bar

N SEEKING a simple method of holding a tool in a boring-har, one small ship finally settled upon the design illustrated. A hole is drilled diagonally

at an angle of 45 degrees to intercourt the hole that DORING BAR a to cortain the horing-tool Thus as tappent tare a not acrew Through point of the setscrew bears against a steel bat, which in turn presses against the buringfood T gettering the screw does not tend to move the



Section thewing the end of a busing bag

tool as is the case when it ly a setacrew in used. Care is necessary to avoid losing the ball when tools are changed.—G. L.

Soldering Overhead Wires

FOR soldering ordinary "pigtail" foints in open house wiring and in various types of overhead wiring, especially in awkward places, it often is possible to speed up the work by making a crucible

for melted solder out of an ordinary 114- or 2-in. gaspape cap or collar as shown. H a collar is used, it is plugged at one end. Two Man. hoies are drilled opposite each other about 14 in from the top, but they should not go quite through the collar or cap. A handle about 2 ft. long

is made of wire, After all the joints are clean and conted with flux, solder is carried from joint to joint. C B.





for solder

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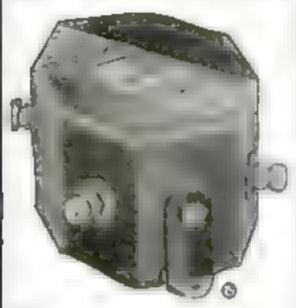
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The Shipshape



Shortcuts in Hanging Cuphoard Doors

IN KEEPING a house shipshape it frequently is necossary to build cupboards, to fit doors in front of shelving, or to do other work that involves the use of hinges.

Most home workers, so far as I have observed, are familiar with the ordinary surface hinge, which requires no especial skill to attach, and the butt hinge, which calls for considerable accuracy and some little experience to fit properly, but they do not know the advantages of what is called the "had-surface" or "halfmortise' hinge. It can be used in many cases where a surface hinge will not do, and at the same time is much caster to attach than a regular butt binge. Altogether, it is an invaluable type of hinge for use around the house.

The first step is to chisel a recess in the hanging stile for the butt or mortise leaf of the hinge. It should be cut se-

curately and of umform depth, so that the surface of the leaf will be flush with the stile or jamb.

When a pair of hinges or three for a large door have been fastened in this way, the door is put in place and held, if necessary, with wedges. The surface leaves of the hinges then are screwed to it. Obviously, much less time is required for this than in fitting a regular butt, and there is no chance of the door's binding, sagging, or giving other trouble.

Full surface or "butterfly wing" hinger



Marking the Jecution of the mortine for a half surface blogs



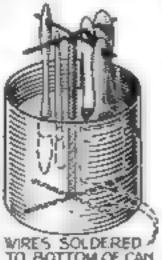
Screwing the one visible hange leaf to the door



Three types of door hingesbutt surface and half-surface

are applied merely by acrowing them on after the door has been wedged in place as tightly against the hanging stile as possible. Unless of special design, they cannot be used when the hanging stile is narrow or molded or not flush with the surface of the door. On furniture they are apt to look rather crude and clumsy. Provided the appearance is not a matter of importance, a narrow butt hinge usually can be applied as a surface hinge when a regular butterfly hings would be too wide .- RUPUS E. DEERING.

Paint-Brush Rack



TO BOTTOM OF CAN Hanger for brushes

Му метнор об supporting brushes in a can of turpentine when not in use is to hang them on a rack made of wire as shown. The wires aretwisted together and soldered except at the ends. which are bent out radially. The lower arms may be soldered to the inside bottom of the can although it is not essential; the upper arma support the brushes Holes are drilled in the

brush handles at the correct height to allow the bristles to be completely covered by the liquid, so that they are in good condition when needed again for work .--W. L. WHERLWRIGHT

Polishing Windows

AFTER washing windows, I give them a brilliant possib by applying

a mixture consisting of 4 tablespoons each of household ammonia, grain alcohol, and pulverized whiting in 1 qt, of water The liquid is allowed to dry on the glass and the window then is given a final polishing

This polishing treatment is reserved for the outside, as the windows inside require only a light rubbing with a chamois skin wrung out in warm water

(Continued on page 139)

in Shipshape Rome

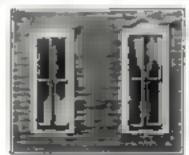
(Continued from page 138)

Cheap Storm Windows

INSTRAD of going to the expense of buying new storm windows for my

home, I made use of the old outside blinds. which had been discarded but were still in excellent condition. I sawed out the

slats and inperted two panes of glass in each blind. The glass was held in place by means of thin strips of wood or glang beads, as they are called .- E. H. SCHLESSMAN.



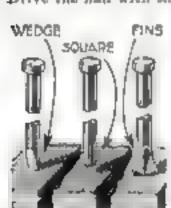
from eld blinds

Hints on Nailing

NAMES are used so frequently in keeping a house shapshape that every

amateur mechanic should know the various tricks that will enable him to drive a nail, even near the edge of thin boards, without splitting the wood

When working with brade or nails of relatively small size, file the point of the null to a wedge shape, if a file is handy, and drive it with this chiesl edge across the grain of the wood. If a file is not at hand, cut the point off entirely with pincers or pliers, or hold the nell against a place of iron and hummer off the point Drive the null with the blunt point. The



Non-aplatting points

advantage of these two methods is that the blant nanwill crush the wood instead of splitting it, as is the case with a nail having the ordinary point

Here is a littleknown method for overcoming the splitting tendency with larger nails, that io, sixpenny,

eightpenny, and up. If you will look at a common wire pail, you will see a series of corrugations on two sides under the head, and, on opposite sides at the point, a small fin or wing. These fine very in size, but are present in some degree on all kinds of nails

The splitting of boards can be reduced or overcome without loss of much time by watching for nails with the larger fine and driving them with the fine across the grain.--- A. J. H

Needle Points for Glazing

BEFORM puttying a new pane in a window, I fasten the glass in place

with old phonograph needles. I find these are easier to drive than the regular V shaped glazier's points. Phonograph needles are equally useful in holding picture-frame backs in place and for other purposes when very sharp steel points are needed in the home workshop.—Dan GERRITY.



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How Much Do We Inherit?

(Continued from \$450.28)

for which environment alone is responsible. Tuberculous, for example, biologists explain, is not inherited. A weakened constitution is, and the child of a tubercular parent is quite likely to be weak. Add to this the fact that the child arrives in a household where it is constantly exposed to tuberculous germs, and one can understand why the child contracts the disease.

Possibilities of inheriting mental disorders often are real causes for concern. Instally and feeble-mindedness are stalking family skeletons, eugenics shows, that never will desappear so long as a single afflicted member in the family, even though himself normal, has children. They both are dominant and cannot be bred out. The same is true of criminal tendersons.

AS FOR genius, one of the Chicago machines shows that the children of brilliant men rarely inherit their fathers' talents. If a brilliant father and a normal mother marry, the father's brilliance will not appear in his children, but may appear in his grandchildren, If, however, both the father and mother are unusual in the same lines, at least one-fourth of the children tend to be similarly income.

We say that we all are born free and equal, but that is far from true, according to investigators of heredity. Brain capacity is inherited and it is impossible to educate a person beyond his limit

Several eminent scientists have been experimenting in the last 10 years to learn whether the effects of mental training could be passed on. Doctor E. C. MacDowell at Cold Spring Harbor recently presented his conclusions after many years of work. He tested the shility of 200 rats to find their way to food in a maze. He found that no matter how carefully one generation was trained, there was no improvement in the offspring in knowing how to reach the food His conclusions were strengthened by those of other experimenters at about the same time.

Were we to realize that we are built to patterns—half furnished by the mother and half by the father—that these patterns, when complete, are made of non-shrinkable, non-stretchable material—in other words, that we are and can be only what our chromosomes make us, science points out, we might realize the importance of fitting together the right sort of pattern pieces.

Plant and animal breeders are applying the mechanics of heredity daily, bringing forth wonderful rust-resisting wheats, delicious fruits, sheep with valuable coats, horses with great speed. Ruman beings carelessly min good and had truits in one grand jumble. Heredity machines such as those in Chicago will at least point out graphically to men what could happen if they cared to use foresight. For should men mate as race-horses are bred, eugenists urge, they might insure for the future a race of beings godlike in beauty, strength, and intelligence.



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What a Junkman Learned

(Continued from page 29)

nated Frank, with an air of much practical wisdom, "is one of the big reasons why cars disappear off the roads. I have seen a seven-ton truck laboring under 20 tons of marble. I have seen passenger cars tested for 1000 pounds carrying 2000 pounds of human higgage and excess baggage. There's nothing that will make a car fit for the wrecker quicker than such abuse."

"But of course, there are lots of other cars that pass out of use as the result of pure mischance, or from inexperience in driving. I know of one man who took his family to the beach for a Sunday outing and parked his car headed toward a bulkhead along the shore. After a while he decided to change his parking

place.

He had forgotten he had left the car in gear. He stepped on the starter, and the machine lunged forward. He got rattled. Instead of throwing out the clutch and jamming on the brake, be put his foot on the accelerator. The car plunged over the bulkhead and into six feet of water. Two of his family were drowned. The car went to the wrecker."

Frank the Auto Wrecker could tell you of many another such tragedy of the road -dramatic stories that are brought to him every day. His piles of automobile "bones" form a startling and often gruesome museum of the thoughtless and foolbardy things that drivers do with

their cars.

Yet, though he profits from the mistaken and racklessness of others, he is by no means the cold-blooded ogre. He sympathises with the costly griefs that motorists bring upon thomselves. He is eager to pass on to them the practical wisdom he has gathered from "chopping up cars into hash."

"Tell them," he repeated, "that the most important thing of all is good oil."

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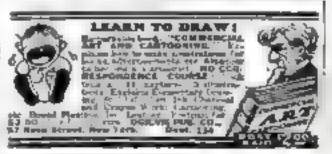
Genetic Studies of Genius, by Lewis M. Terman. Results of tests given a thousand gifted children in California to determine their physical, mental, and personality traits. Stanford University Press.

The Evastein Theory, by Samuel H. Guggenheimer. A popular discussion of the Einstein theory, emphasizing its bearings and significance. The Macmillan Company

Education through Wood Working, a series of essays by teachers of woodworking, compiled by the American Woodworking Machinery Co., Rochester, N. Y.

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Simple Inventions Most Profitable

(Cantinued from page 27)

official position in the company in payment for his patent. But my usual method, after I have secured a patent and devised marketing plans, is to start manufacturing the invention myself Then, after I have proved that a demand for it exists. I have little trouble selling the patent at a good figure to some manufacturer in a kindred line, or to some one who wants to get into the manufacturing business. Once you have proved that people will buy a patented article it is easy to sell the invention profitably."

"HIS man invariably has invented I things that many people need—among others, a flat collar button that relieves the pressure on the back of a man's neck, and an alarm bell that, attached to the drip-pan of a refrigerator, indicates when the waste water in the pan is about to everflow.

In no field of human activity have the possibilities of profitable invention been exhausted. Every great basic invention in followed by hundreds of profitable lemer inventions.

One of the early motor fortunes was made by a man who invented an automobile born. When the automobile was new, the warning devices then in use were fulling to the ear. The inventor decided that comething startling was needed, and he devised a horn with a "hoot" that convinced the most absentminded pedestrian that it was time to move

in this case the demand was not walting, and an extensive advertising campaign was necessary to convince the motoring public of the merita of the new horn. But in the end the inventor woo out, and made a large fortune.

While Henry Ford and a host of other automobile inventors have been making their millions in motors, people have continued to walk on sole leather. They have been doing that for several centuries, and footgear seemed to offer a barren fleid for inventive genum—until the thventor of the rubber heel appeared. Now 90 per rent of American men and 20 per cept of American women wear them.

Elian Howe's idea of putting the hole in a sewing-needle near its point instead of in its head made him a profit of more than a milion deliars, and by making possible the sewing-machine, laid the foundations for geveral big fortunes beside his own. The four-motion feed invented by Allen B. Wilson made him a rich man. Singer, who had to borrow \$40 to pay for making a model of his machine, lived to receive an income of \$3,000,000 in a single year James C. H. Gibbs also made a fortune.

BUT to get back to simpler inventions. We have become so accustomed to finding a rubber graser attached to our lead-pencils that we have forgotten that until 1858 pencils did not have this convenience. Hyman L. Lipman was the inventor who hit upon the trouble-saving device, and he profited to the extent of several hundred thousand dollars.

For a long, long time people have been buying and selling various liquids in bottles, and for as long a time they have been looking for a stopper that was secure, convenient, and inexpensive. The first improvement over the old-fashioned cork was a rubber stopper tightened by an outside wire attachment that acted as a lever. Its inventor made \$15,000,000. Then came a Baltimore inventor with a metal bottle cap that was cheap and secure. He amo made a fortune. There is probably another fortune waiting for the man who patents a cap as inexpensive and as secure as the one now used, but that can be taken off without the aid of a bottle-opener.

THE use of came as containers of food led to the inventions of various types of can-openers. In apite of these aids, opening caus remains one of the annoyances of modern life. Perhaps it will be aboluhed by the recently invented can that has a seam just below the top that, when struck, opens the can. A big Chicago packer thought so well of this invention that he gave a first order for 10,000,000 of the cans. Manufacturers of shoe polishee are eaid to be willing to pay well for a pollah tin that is airtight, easy to open, and inexpensive to manufacture.

A few years ago an inventor decided that amateur photographers would find it a convenience to be able to note on their films the date on which each picture was taken and other memoranda. He invented the autographic film and made \$300,000. A rug-dasplay rack brought its inventor \$30,000. A glass lemon-squeezer made \$50,000 for the man who patented it. The inventor of the grooved umbrella rib made almost a milhon dodara. A tire chain to keep automobiles from skidding on slippery roads was worth as much to its inventor

Shipping tage used to have a troublesome habit of tearing loose from their twins or wire fastenings. An inventor devised a tag with the eyelet reinforced by a still paper ring. Simple—but it made a fortune for him, and around that invention a great business has been built

The habit of keeping both eyes wide open for possible improvements in articles. already in use is a valuable asset for the would-be inventor. A good many million paper bags have been used by clerks, but they left it to a shop girl to invent the satchel bottom paper bag. She sold the patent for \$24,000. That was only a thousand dollars less than King George V of England got for the patent for a movable fireplace for workmen's dwellings.

 $\mathbf{\Gamma}^{\mathsf{HE}}$ successful inventor must be able to form an accurate estimate of how great a demand there will be for his invention. Some years ago a young man devised an ingenious method of automatically counting the number of words written on a typewriter. A typewriter manufacturer offered him \$10,000 for the natent. The inventor laughed scornfully. He did not stop to think that it is easy to

(Continued on state 141)

Profit in Simple Inventions

[Continued from page 142,

estimate, accurately enough for most purpases, the number of words on a typewritten page. He didn't make a cent out of his very dever invention.

Motion pictures have opened another rich field for invention. Sixty-eight per cent of the American public goes to the movies, and 150,000 films are made each year. Any device, simple or complicated, that will make motion pictures better will find a ready sale and should bring its inventor large returns.

Radio, likewise, still is in its scientific and industrial infancy, and offers unbounded opportunities to the ingenious

and wide-awake inventor.

AMERICANS spend a miltion dollars a week for sporting goods, and a large proportion of these dellars is paid for golf supplies. The man who patented the golf tee already described is not the only one who has realized the possibilities of invention in the game that holds the interest of so many of our citizens. A single number of The Official Gazette, issued weekly by the Patent Office, contains notices of the granting of patents for a golf club with a pivotally mounted head that is adjustable to the stance of the user, for a golf-hag latch, for a golf club huilt like a aplit-bamboo fishing-rod, and for two patent golf tees

This Official Gasette of the Patent Office is the current history of American invention. Glance through its pages and you will get a picture of the wide sweep of inventive genius. In one week patents were issued for an ore-smelting furnace, a Breproof legging, a garbage receptacle, a station indicator for radio receiving sets, a can-opener, a rurder retainer for airplanes, a paint-bucket stand, an airship with a huoyant keel by means of which the ship may rest on the water, a fishhook holder, a belt-lacing needle, an articuinted link for the cartridge beits of machine-guns, an asphalt shingle, an automatic telephone system, a fountain safety razor, a tractor mower, a window lock, a valve for milk-pasteurizing tanks, a baseball, a log-loading machine, a die for forging clawhammers, a card game, a null-puller, several can-openers, a compressed-air motor for pumps, and a shoe innole.

THESE are just a few of the 875 patents issued in a single week They range all the way from complicated inventions that have taken years of study to perfect, to simple little devices that sometimes are the result of a swift thought and a few hours of experimenting Some of these patents may win fortunes for their owners, others will not be worth the trouble of getting them.

Every 13 minutes an invention is made that is patented. Yet there are not enough inventions. Every day the

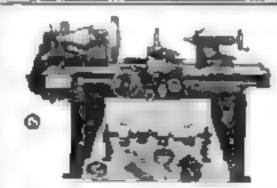
modern world develops new needs. It is the inventor who must fill these needs. If, before devoting too much time to his invention, he will make sure that it does

fill a real need, he will find a market waiting for it, and a fortune waiting for

its inventor

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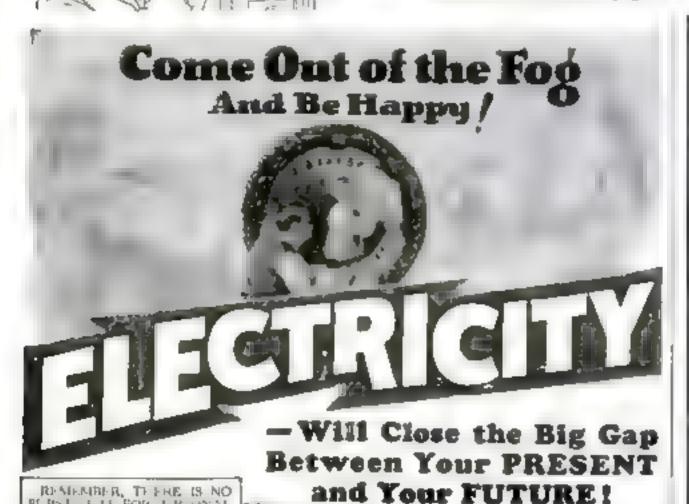
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When Your New Set Arrives

(Continued from page 62)

sulating material is, of course, such stuff as hard rubber, glass, porcelain, or any of the other compounds specially recommended as insulators.

After the antenna is connected with the receiver, the next job is to install the ground connection. The latest rules of the fire underwriters allow the use of bars copper wire not smaller than No 14 gage, and since the ground wire need not be insulated, you can run it along a corner of the floor where it will not be noticed. One and of the ground wire connects with the ground binding post on the receiver and the other end with a

What Is Your Problem?

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- 2. In what room shall I put the radio receiver?
- How can I hide the batteries?
- 4. Where will the loudspeaker sound best?
- Will apecial lighting be necessary?

If any of these problems are bothering you, POPULAR SCIENCE MONTHLY stands ready to help you with advice or information. Be sure to write us full details.

ground clamp fastened around the nearest cold-water pipe.

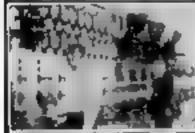
If you use storage batteries, he sure to place a rubber mut or glass tray under them. It is not necessary to keep the wires from the batteries to the radio set separated from each other, provided, of course, that they are insulated wires, but if you bunch them together, he sure that you do not make a mistake and connect the wires from the B batteries in place of the A battery

IT is always well, in any case, to connect each wire with receiver first, and then run it to the proper terminal of the battery rather than the other way around, because in the latter case, the loose end of the wire that already is connected with a terminal of the battery may move around and accidentally short circuit against some other wire or binding post.

Although the length of the wire between the radio receiver and the loudspeaker is not important, you probably will find that the loudspeaker sounds best from some one particular position in the room. It is well, therefore, to experiment a bit after you have the whole outfit working properly. Usually you will find that the best position is near one corner of the room where the joining walls set to reflect the sound and help to reinforce, through resonance, the deeper tones.

What is considered a record for amateur radio transmission was made recently by Gerald Marcuse, a London amateur expert, who spoke several mornings direct to the wireless operator abourd a warship stationed at New Zealand—12,000 miles.

Making



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(Continued from seat 50)

of condenser C alters the electrical capacity of the condenser and when the signal becomes loud, it is because the capacity of the condenser has been so adjusted that the combination of roil B and condenser C has been tuned so that the current flowing back and forth can keep time with the changes in the current in coll A

Naturally you cannot hear vibrations in the air that are changing as rapidly as 1,500,000 times a second. In fact, the highest note the human ear can hear has about 30,000 vibrations a second.

The voice or music going into the mierophone at the broadcasting station has the effect of chopping the radio wave into sections and the sections are in time with the music. This is where the crystal detector comes in. Its function is to block off half of each radio wave so that the whole group of rapidly changing waven that form one vibration of the music will act together to pull the diaphragm of the head phone in one direction. Then the next group of radio waves comes along and gives it another pull, so that it moves back and forth in time with the music and you can hear it.

The reason that a crystal radio receiver will bring in music only from abort distances is because the sound in the head phones when you use a crystal set actually is produced by the energy of the radio waves themselves. In a vacuum-tube receiver, on the other hand, the radio waves simply are used as triggers to release relatively far more powerful bursts of energy from your batteries. And this explains why reception with a crystal receiver is so true to life. There is no chance for distortion to creep in, due to faulty vacuum tubes or batteries.

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I believe that for downright enjoyment to a man of mechanical inclination. there is no better magazine published. Certainly I enjoy nothing more than keeping abreast the world of science and invention, made possible by POPULAR SCIENCE MONTHLY .- A. K. M., Bowden, Aita., Can.

From a Home Worker

I have made a good many things that I have learned how to build from POPULAR SCIENCE MONTHLY. I have made footstools with springs, hatracks, kitchen tables, workshop bench, writing-desk, chest, tool cabinet, trellises for the house, just in my spare time, and I am very interested in your magazine.-J. J. B., Binghamton, N. Y.

Mines of Information

I always have taken the greatest interest in the Home Workshop and Shipshape Home sections and for a long time have been cutting out the "tidbits" of special interest and putting them in scrap albums. Consequently my albums are regular mines of information, and the envy of my mechanically minded friends. -E. B. R., Regina, Sask., Can.

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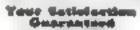


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Here Are Correct Answers to Ouestions on Page 39

- 1. This is a case of the work of the yeast plant. Fermentation means merely that yeast is growing in the cider. The yeast produces alcohol and carbon-dioxide gas just as it does in bread and that is where the bubbles of gas in the cider come from.
- Probably the dog, though it is possible. that in some parts of the earth the sheep or the pig may have been partially domesticated before the dog was, or at about the same time.
- 3. They indicate the frequency of a wave. One "cycle" means one complete wave. A "kilocycle" in 1000 cycles or Wayen.
- 4. There is no evidence that they are changing at all. Some prehistoric men were short and some were tall, just as men are today.
- 5. No. There is no recorded case of any one having been bit. Most of the falling stars are so small that they do not reach the earth's surface at all, but burn up by friction in the upper part of the air, making the streaks of light that we call "shooting" stars.
- 6. Yes, put it in a vacuum. The temperature at which water boils depends on the air pressure—the less the pressure, the lower the temperature necessary for boiling. Water placed in an ordinary vacuum will boil at about 50 degrees Fahrenheit
- 7. Thus is another instance of blood leaking out of the blood vessels. The flesh around the eye is rather loose and When blood gets out into this sporgy timue, it aprends around for quite a distance and makes the whole neighborhood of the eye look blue or black.
- 8. They do not differ at all in chemical composition. Both are composed of oxide of aluminum. In both cases the red color is due to a little impurity. In the artificial stones this is added on purpose
- In the center of the whist of the storm, the black funnel that corresponds to the waterspout at sea, the centrifugal force of the air, makes a partial vacuum. If this vacuum passes over a bouse the air inside the house does not have time to escape through the windows and doors, so it blows up the house.
- 10. Yes. Some low forms of animals become females when fed on plenty of food or on certain kinds of food. When fed on other kinds of food or given too little of it, the same animals become males.
- 11 Yes. The action of our nerves is lacie red to be electrical. Other electrical changes are taking place all the time in our bodies. All there are very small in amount. We cannot produce at any one time enough electricity to cause a shock or to be perceptible at all, but delicate scientific instruments can detect our bodily electricity ossily.
- 12. It has, by far, the best blood supply of any organ in the body. The gray matter that we think with in especially nch in blood vessels and the continual stream of fresh, rich blood around the masses of nerve cells in it brings to the cells the food they need

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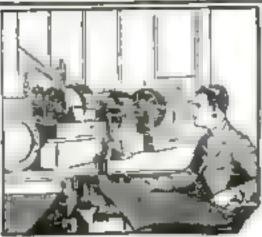
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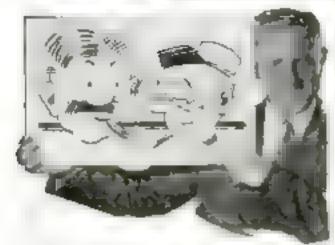
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Unmasking Spirit Fakers

(Continued from page 14)

Thus, I have heard an alleged spirit of George Washington speaking with an unmutakable cockney accent. I have heard the "spirit of Shakespeare" make grammatical errors and use modern alang. It was something of that sort that caused me first to doubt the good faith of the average medium. When I was about 16, I attended a series of stances given by a medium—a tailor at Belott, Wis. At the time I was a confirmed believer in spiritualism. Thus medium had impressed me greatly by the fact that he habitually put his sitters in touch with the spirits of great men-George Washington, Abraham Lincoln, Napoleon, Columbus—his séances were a constant panorama of hutory.

ON THE night that the "spirit of Lincoln" began to address us, my interest mounted high, for Lincoln was my here of herees. I had read and studied every Lincoln book that was available at the time. I know every published detail of the Great Emancipator's life. And I was vaguely conscious that night of something about the utterances of the "spirit" that did not ring quite true. So at last,

"Mr Lincoln, what was the first thing you did after your mother was buried?"

'I felt very bad," replied the "apprit" giby I went to my room, and I wouldn't speak to any one for days."

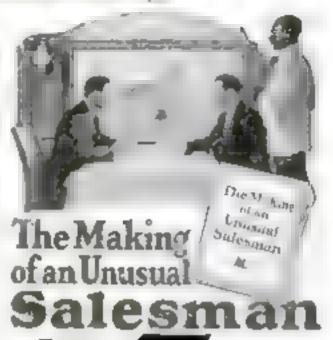
Now, that reply probably would have been correct in a majority of cases, but it was not correct with regard to Lincoln. For Lincoln's first act when his father had buried his dead mother was to rush off to engage a clergyman to read a barial service over her grave-an act of respect which his father had neglected! And this was certainly not an incident which Lincoln was likely to forget-in the spirit world or elsewhere.

Although this happening did not shake entirely my faith in spiritualiam, thereafter I watched closely the methods by which the tailor-medium accomplished his effects. One thing I noticed was that no matter how many "spirits" talked at his séances, only three voices would be heard, and these same three voices were heard at all séances, no matter what "spirits" appeared. When I inquired from the medium the reason for this, he looked at me intently for a moment, then laughed in an embarraged way and said

"Well, you've caught me; but you've got to admit that I do more good than harm by consoling sorrowing people who long for a message from their loved ones!"

"AUGHT him! I had no intention of Catching him! On the contrary, it came as a painful shock to me that one whom I had trusted and believed in completely should so readily confess himself a fraud. When I had asked him about the voices and an odd bassing noise I frequently had beard in the trumpets which he med, I had been innocently seeking information about what I regarded as my religion. However, I was quick-witted enough to take advantage of his unexpected revela-

Continued on page 153)



Here are Some of the Records

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Unmasking Spirit Fakers

(Continued from page 152)

tion. I permitted him to infer that I had been on to him all along.

"But, surely," I saked, "all mediums are not like you? There must be some genuine ones?"

"None that I know of," he said with a grin. "They're tricksters—every one of them!"

And it is with sincers regret that I must report that my 35 years of investigation of mediums in all parts of the world have given me no reason to doubt the statement the tailor-medium made to me then.

For years I have offered—with never a successful challenge—as much as \$10,000 to any medium who can produce under conditions laid down by me any physical manifestation of his boasted psychic powers that I cannot duplicate by the methods I use as a professional magician. I make this offer again in the columns of POPULAR SCIENCE MONTHLY

FOR years I have been duplicating the most mystifying feats of the mediums from the stage—and then explaining to the puzzled audiences exactly how the tricks are accomplished. My success in this work has caused believers in spiritualism to declare that I am a psychic-a medium-without realizing it myself Such a statement is of course abourd Every fast that I ever have performed on the stage or off has been accomplished by purely natural means that are explainable by the laws of science and that would be understandable to any one to whom I chose to divulge my secrets.

Once when a spiritualist was endeavoring to convince me that "spirits" aided me in performing the "escapes" that are part of my theatrical routing, I said to him:

"My friend, for many years I have been forced to sleep with a pillow under my back. That's because a gang of lungshoremen crushed one of my kidneys with a chain while tying me up on a stage at Buffalo, N Y. Why weren't the spirits on hand to help me then?"

He couldn't answer the question, of course, but I am quite sure if he is still living, he is still a spiritualist, for I have found that the objections one offers to even the most unfounded beliefs of spiritualists usually have scant effect. Spiritualists will believe—those of them, that is, who are not frauds, for I have encountered only two kinds of aptritualists—tricksters and the deluded persons upon whom they prey,

AND the latter are not to be shaken even by proofs that the "psychic manifestations" of mediums are accomplaced by trickery. Mediums that I have caught red-handed-or black-handed, as the Cleveland medium I told of above-invariably have found stalwart defenders among those whom they have been fooling. After I had exposed a trumpet medium in New York City a few weeks ago, one of the medium's dupes attempted to attack me physically and only densted on learning that police were in the room

The spiritualist believers have a stock (Continued on page 154)

How I Was Shamed into Popularity

For some reason I could never get out of the wall flower class. But one night I had a bitter experience that changed everything. Here's what happened,

By JAMES PRESTON

You know, I once thought nerve alone was though to get by anywhere. That is, I thought so till I met Olive. You never in your life on w two people take to each other the way we did. If only that dance party hadn't come-

But dances are what parties are made for I sat ent two or three feat truts was burg there aids around in the arms of they men and then I de-inted to take a turn will be injust. At the very first notes of the orchestra I awa uswed a lump of fear and taking a hold that must have been funny if it weren't so pathetic- I started what I thought was dancing.

Wherever did I get my nerve? Where did that girl ever get her in sence? I must have stambled twenty t men and then in the middle she winted with thus and it inted to tak her toes. Jack-ler's not finish this date: I m I m I ded anyway, also idded at ageing with herself to be nice to me. I given it added at use ng with herself to be nice to me. I goes a turned a re win courts. Just then I wanted the ground to open and evallow me up.

But that alght I cat up and thought—suddenly it downed upon me why I was an unpopular. Equally suddenly it occurred to me that there was a quick simple remedy that I had seen aften yet never heredod.

That very next more ag I wrote to Arthur Murray

American forement gameing tentructor asking him for his 12 stage brooklet and Fire Test Lemon-encioling only the to cover postage, printing, etc.

They came promptly and showed me at once how easy it was to become a good dancer—even the hardest dance step test me once a few minutes to learn.

Now the grill are glad to accept whenever I set for a dance. I haven't known what a long-one evening in once.

Whether you've had an experience like this or not

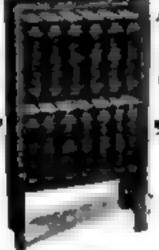
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THE W. L. EVANS SCHOOL OF CARTOONING

Unmasking Spirit Fakers

(Continued from page 153)

excuse for a medium who is detected in trickery.

"Well, yes," they admit, "you caught him that time—but that was because he had suddenly lost his power. It's only in such cases that he's forced to resort to trickery "

For 35 years I have been encountering that kind of logic. It has been a severe test of my patience.

Even so noted a man as Sir Arthur Consu Doyle, author and prientist of world-wide reputation, creator of Sheriock Holmen, probably the most coldly, rigidly logical character in English fiction, many times has used much the same sort of specious ressoning when I have challenged the basis for his faith in spiritualum,

He is one who firmly insists that my stage tricks are performed with the aid of spirits; that I am a psychia. Once he went so far as to sak if I was "the last word in religion and science in America."

WELL, Sir Arthur," I replied. "not exactly that But, if you were to build a packing-case large enough to contain me and all the American spiritualists and the scientists that uphold them, weight it with pig fron, tle us up in it and throw it into the sea, I'd be the only one that would come up. But it would be trickery that would release me," I added.

Frequently you will hear some one speak of a medium about like thus:

"He must be genuine. Why, the spirits that talked in his place told me things that nobody but myself knew." Bunkt

Early last summer Police Commissioner Enright, of New York, saked me to lecture at the New York Police Academy, to explain to the members of the police force just how to go about detecting fraudulent mediums. The best and most direct way that occurred to me of doing this was by staging a stance, performing myself the tricks that the mediums use.

AFTER a little hocus-pocus to add solemnsty to the occasion—my seance, by the way, was performed in broad daylight—the "spirit" with which I sileged I had established communication asked "Is Lieutenant Smith of the Eighteenth Precinct here!"

Much mystified, the lieutenant soknowledged his presence.

"I," eard the "spirit," talking through me, of course, "am the spirit of John Brown, whom you saved from drawning at the foot of East Ninety-First Street in 1920. I want to thank you for that and to congratulate you on your promotion. There'll be another promotion coming to you soon. Tell your boy Joe not to worry about his examinations; he's going to page. And tell your wife not to worry about the baby The little girl will get through the hot weather all right."

Lieutenant Smith had never spoken to me in his life, nor I to him, so naturally he was thunderstruck when the "spirit" singled him out from the big crowd of policemen present to tell kim all this,

(Continued on page 155)

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Unmasking Spirit Fakers

(Continued from base 154)

No doubt you, too, would be amilarly astounded were I-or a medium-to tell you something similar under similar conditions. And yet there is nothing astounding about it. I was able to call that lieutenant by name because I had learned his name from one of his brother officers. I was able to tell him about the rescue because the same officer had told me about it.

MY INFORMANT also told me that Lieutenant Smith had been promoted recently, that he was married, and that he had a boy of 12 and an infant daughter. Innamuch as the schools were scheduled. to close for the surnmer in a couple of weeks, it was easy for the to guess that Jon was worried about passing his examinations. And since summer was coming on, I was quite sale in assuming that Mrs. Smith, like every other mother I've ever met, would be concerned about how her baby was going to stand the hot

Simple, lan't it? Yet how mystifying when you're not in on the secret!

A favorite dedge of the mediume, that one! Almost invariably they work it on newcomers to their senness. Sometimes the surprising personal details related by the 'spirit' are supplied by the spiritualat friend who has introduced the visitor, for apiritualists like to make converts, and if they can do so by beiping the medium in his trickery, they'll do it.

IVE a clever medium a man's name, address, and occupation information that reachly can be obtained from the city directory—and with the aid of a few seading questions and a little deduction, the medium can convince that man that be knows the innermost secrets of his soul.

I do this sort of thing from the stage regularly as part of my work of exposing the tricks of fraudulent mediums. One of my most useful pieces of equipment in this connection is a library of city directories of the lending cities of the United States. With their aid I am able to tell persons in the audience most estounding

Thus, while playing in New York recently, my assistant, whom I had stationed in the labby for the purpose. related to me a brief exchange of conversation between two men, overheard while they were passing through the labby of the theater

"Well, Mr. Blank," one said to the other, "how are things out in St. Louis"." "Pretty good," replied the other; "we've

sold a lot of cars this year."

With this much to guide me, it required only a moment to ascertain from the St. Louis city directory the full name and address of a Mr. Bank—the name I use is fictitious-who was in the automobile business in that city. Later from the stage I called Mr Blank by name. told him his husiness, made the obvious guess that it was business that had called him to New York, gave him the assurance of the "apirita" that his business trip would be successful, and otherwise astonumed

(Continued on page 150)

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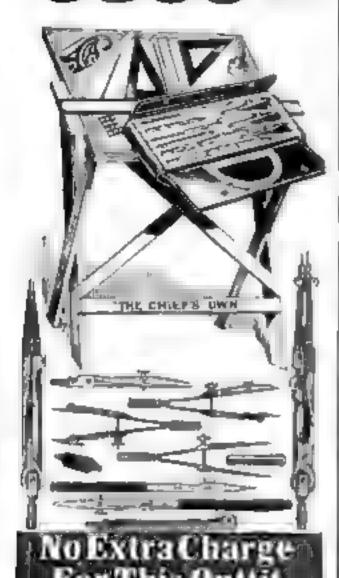
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Unmasking Spirit Fakers

(Continued from page 155)

him and the audience by my supposedly spirit-given knowledge of his personal

AT ANOTHER performance in the same theater I absolutely flabbergusted a man in the audience by calling him by name, and informing him that he had come to the theater to escape from a quarrel be was having with his wife.

I linew this because I myself had observed the couple guarreling on the sidewalk before the performance began, had heard the wife call the man by name, and had seen him rush into the theater and buy a ticket.

On account of the prominence of the persons named, a demonstration of this sort of mediumistic trickery which I gave in a Boston theater not long ago caused quite a stir.

"Is John Lewis Bates in the audience?" I asked from the stage, naming a former rovernor of Massachusetts.

Governor Bates acknowledged his

"The spirit of the late Governor Curtis Guild is here," I announced, "Probably you don't believe this, but I'd like to convince you. The spirit wants to know why you cut off the side whiskers that you used to wear. You used to wear side whiskers, didn't you?"

"Many years ago," replied the ex-TOVETHOT.

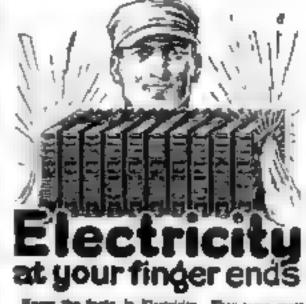
THE spirit also wished to know if you recall having dired with him at the Algonquin Club in Boston when he was governor about 20 years ago."

"I recall it very well," was the response. "He wants to know if you recall the subject discussed. It was Jesse Pomeroy, wasn't it?" I asked.

"Yes," ruplied Mr. Bates, thoroughly astonished, while the audience gasped in amazement. "But how did you Imow?"

The explanation is almost unbelievably simple. I knew, of course, that former Governor Butes was in the audience. I also knew that he had formerly worn side whiskers, for I had seen him wearing them. on another visit to Boston about 25 years ago. Also, former Governor Curtis Guild, journalist and soldier, was my personal friend. I had been his guest at the Algonquin Club in Boston. He had told me that it had been a customary procedure to present a petition for the pardon of Jame Pomeroy, the famous boy murderer, to each successive governor of the state. Knowing all this, it was easy for me to piece together the tale I unfolded to him from the stage that night. A few facts, and a little artful guessing that is all the material a dever medium requires to mystify the average person.

NEXT month Houdini will tell other dramatic stories of his adventures with spiritualistic fakers, revealing secrets of their tricks and explaining the ingenious and often startling ways in which he has exposed them. You won't want to miss the second installment of Houdini's own story in the December Issue.



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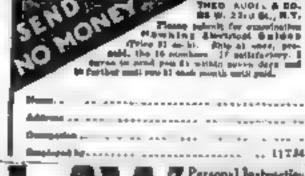
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There's Magic in Numbers

(Continued from Sant 30

numbers and compare the result with the answer on the folded skp. They will be identical.

The secret of this stunt lies in the third. and fifth numbers. When you set these down, you see to it that each digit when added to the corresponding figure above set down by the subject, totals 9. This is how it works:

Subject's f	gures	16,942
Subject's		26,453
Your	44	73.546
Subject's	41	39,201
Your	14	60,798

Total 316,940

ALL you have to do to get the total is to add a 2 at the left of the original figure and subtract a 2 from the right. Thus you can tell quickly at the start what the total will be.

What you really have done is to add a pair of 99,999's to the original number. This is 2 less than 200,000. By adding a 2 at the left and taking away a 2 from the right, you actually have added the 200,000 minus 2

To make this trick very mystifying, use a confederate who pretends to be ignorant of how it is done. Let him put down the third and fifth numbers, then you yourself, apparently, have had nothing to do with the figures, and how you got the answer by seeing only the first number will be astounding to your audience.

A similar trick is one in which you always get the same total. Ask the victim to write down a number of three figures in which the last figure is 2 less than the first one. Say he chooses 836. Tell him then to write the figures backward and subtract them from the original, reverse these and edd. Thus-

Number in mind	836
Reverse and subtract	638
Result	198
Reverse and add	891

Total 1989

The answer always will be 1089, no matter what numbers are used. But this trick, to be really effective, requires a bit of staging. When your victim has finished his calculations, ask him to let you know what the third digit of his answer is. You then pretend to ponder deeply before announcing the answer

ANOTHER interesting pastime with figures is to be found in numerology, which purports to be a science that determines the influence on your life of numbers corresponding with the letters of your name. Every letter of the alphabet is supposed to have a corresponding number, and each number is supposed to have a specific meaning. The letters of your name, reduced to their corresponding numbers and added, are supposed to give you the key to your character and your possibilities for fortune.

Obviously scientists agree that there is no science whatever in numerology, yet it offers an interesting fortune-telling game.

To analyze your name, first reduce the letters in the name to numbers by the

(Continued on Juge 153)



I Was Afraid of This New Way to Learn Music

-Until I Found It Was Easy as A-B-C

Then I Gave My Husband the Suprise of His Life

You're perfectly "Don't be sitly, Mary foolish to believe you can learn to play music by that method. You are silly to even think by that method. You are silly to even think about it. Why it risins to teach music in half the usual time and without a tracker TILL En Merchild

That is how my hasband felt when I showed him an ad telling about a new way to learn music. But how I haird to give up my new hope of learning to play the piane. When I heard others playing. I envised them so that it almost specied the pleasure of the music for me. For they could entertain their friends and they were musicians. I had to be Learning ... ant shed with only hearing music.

I was so ossappointed. I felt very bitter as I

put away the magazine containing the advert. sement For a week I resisted the temptation to look at it again, but heally I couldn't keep from pecking at it. It (assumated me so much that finally, half fragitized half enthusiastic I wrote to the U.S. School of Music without letting my husband know.

imagine my joy when the course arrived

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and I found that It was no easy as ABC Why m mere chald could master all My progress was wanderfully rapid and before I realized at I was rendering selections who is a h pupils who study with private teachers for years can't play. For cut method, all the difficult, tireterme parts of music have been eliminated and the playing of melodies has been reduced to a simpacity which anyone can follow with ease

One day not long after my hashand came to me and mid, "Mary, don't hugh, but I want to try learning to play the violin by that wonderful method. You certain y proved to me that it is a good way to learn music.

So only a few mon his later Jack and I were playing together. Now our musical evenings are a marvelous success. Every one compli-ments us, and we are flooded with invitations, Music has simply meant everything to us. It has given us Popularity! Fun! Bappiness!

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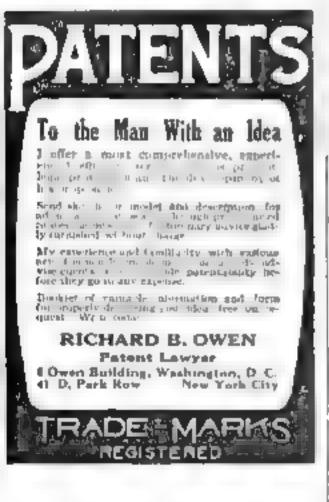
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There's Magic in Numbers

(Continued from page 137)

following table, reading it downward

1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P O R S T U V W X Y Z

Now add the numbers of al. the vowels in your name. The total is supposed to tell you what your inner characteristics are. Next add the numbers of all the consonants. The resulting number is supposed to indicate what outer influences for success or failure are attracted to you. The sum of vowels and consonants together is supposed to give you the full meaning of your life. Since there are only single numbers in the table of meanings given below, you must reduce any double numbers in your totals to a single figure. Thus if your total happens to be 46, add the 4 and the 6, making 10. Then add again, I plus 0 equals 1. The total to be interpreted then is 1.

The numbers and their meanings are

as follows:

1. Courage, independence; the ploneer.

Tact, kindness, and conventionality; domesticity

 A combination of 1 and 2—a many sided nature.

The symbol of failure, money troubles, and tragedy.

The rolling stone, restlessness, shortlived enthusiasm, inability to "stick."

Most staiwart of all numbers; honesty; the good citizen.

 Symbol of loneliness and minunderetanding; beauty of spirit, gentleness, and poetry

5. Material success, wealth and power.

 Success in the arts; talent, imagination.

FOR example, suppose your name is "John Roberts." You would figure it out like this

Vowels 6 6 5 (equals 5)

JOHN ROBERTS

Consonants 1 8 5 9 2 9 21 Total 37

equals 19,

equals 1

Final total is 6 plue 1, equals 9

John's name-numbers, 8, 1, and 9 indicate, according to numerology, that his best chances for success lie along the lines of artistic endeavor. He has the support of courage, financial ability, and strength of character. Numerologically, he has an excellent name, and should not change it.

There are two numbers that are exceptions from all rules—11 and 22. They are not reduced to single figures but allowed to stand when they occur in a name, since they represent genius. The number 22 represents mystic power and beauty; 11, power and greatness.

EARTHWORMS as songeters! You think of them as grubbing creatures; but they may lift their cares in melody. A German soologist, Professor Mangold, placed a dozen earthworms under a glass cover and to his surprise sounds of soprano pitch in rhythm came from within. There was no other source for the music present, declared the professor

Foresight Saves a Crash

(Continued from page 44)

cars that smashed into the wreck forgot the most important rule of the road. All they were thinking of was getting along in their own cars. What they should have done was to pay a lot more attention to what was likely to happen to the driver of the car shead. Strong brakes are all right, but what good will they do you if you let yourself get caught where even locking all four wheels won't stop you in time?"

"But suppose you can't see what's going on beyond the car right in front of

you?" demanded Joe.

"Then you should stay so far away from the car shead that you'll have space to stop, no matter what happens. Look at that book behind us," he directed, pointing to the reflecting mirror above his head. "If I stopped suddenly—or even slowed down—he'd ram me, sure as your name is Joe! He's not paying attention to his driving—he's admiring the scenery. It's fe lows like him that cause most of the accidents—if you ask me

"WHEN a man is driving a car, he ought to keep his mind on his job. And he can't do that if he insute on eight-seeing or turning around to talk to the people in the rear seet. I once saw a fellow run off a perfectly straight road and prie up in the ditch just because he insisted on talking to the passengers in the back. He was an old fellow and in his younger days he had driven a horse quite a lat. Horses stay on the road without being steered, and he couldn't get it in his head that an automobile wouldn't do likewise.

"The whole trouble is that so many drivers don't use any common sense in their driving. You can make all the truffic rules you want to, but they won't do much good unless the drivers of cars

live up to 'em.

"That goes for special warning signals on the back of the car, too. What good are they if the man behind you doesn't pay attention? Most warning signals are set wrong anyway. The 'slow' or 'stop' sign fisshes on the instant you press the brake podal. They should be set so that the light will not fissh until the brakes are actually applied hard snough to slow down the car. If warning signals were all set that way, then when an auto-driver saw a light fissh up on the rear end of the car shead of him, he would know that it meant business."

"You're dead right about warning signals," assented Joe. "But I thought they slways were adjusted to light when

the brakes went on?"

"They are when the car is new, but when the brake linings wear a bit, the average owner doesn't bother to readjust the switch on the warning light. And as for hand signaling, just take a look at that flivver in front?"

"Gosh!" said Joe, "Looks just like a centipede on its back! I wonder what

they are going to do?"

"One, two, three—six hands out altogether—and no two pointing in the same direction!" Gus growled disgustedly.

(Continued on page 160)

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Foresight Saves a Crash

Malking

(Continued from page 159)

But in spite of all the hands, the flivver continued at a slow pace without swerving.

Gus jabbed the horn button viciously The road was narrow and winding, and Gus did not want to have to go down into the ditch to pass.

Immediately the hands began waving wildly and then the flivver grouned and chattered as the driver brought it to a halt squarely in the center of the road

Gus waited a moment, assuming that something had gone wrong with the heavily loaded little car, but no one climbed out and voices raused in a wrangle floated back.

"Can you best it!" exclaimed Gus angrily. "Stopping right in the center of the road while they argue about whether they are going in the right direction?"

US kept his finger on the horn G button and it finally dawned on the driver of the flivver that his car was blocking the road

"That's the trouble with hand signaling," said Joe. "Half the time you can't tell what the car shead is going to do even when the driver does stick out bus band "

"Yee," said Gus; "and if any signaling is to be done, the driver is the one to do it. Nobody else in the cut should stick out a hand under any circumstances. Lots of times I have jammed on the brakes because the fellow in front stuck out his hand unexpectedly in such a way that I thought he intended to make a left turn, and then after I had burned a lot of rubber off my tires, he turned off the road to the right. Fashions in hand signaling are changing all the time and, to make it worse, the proper signal for one locality may mean comething also when you cross the state line. Some day we'll have a standard system of hand menals for the auto-driver that will be enforced all over the country. Meantime the only thing to do is to play safe, so that no matter what the signal means you will be able to avoid a smaah-up."

"Seems to me," commented Joe, "that a lot of signaling is unnecessary."

"It sure is, and usually the better the driver the less signaling he has to do. If you keep on the right eide of the road where you belong and you make a turn into a road at the right, there's no reason why you should signal at all unless you have to slow down quite a bit to make the turn. Then if you make a habit of constant to a stop and always slowing down as gradually as possible, the man behind doesn't need any signals.

"Weil here we are at Turner's Corners." Gus concluded, as they pulled up in front of a ramshackle building that housed the post office and general store

They climbed out and Gus started to assemble his shotgun.

"There's just one sure rule for safety in auto-driving, Joe," Gus sagely observed, as he carefully fitted the barrels to the stock: "Know the rules of the road yourself and live up to them, but don't ever bank on the other fellow having any sense! Now for some good rabbit shooting!"



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Every Day's Work a Gamble with Death

Continued from page 30)

planks and rails, but we had to guess where to put them and we had to tie them together because no wood would stay up in that mess. The water was up over the box cars All you could see of some houses were the peaks.

"We worked night and day, 170 of us, anchoring wooden bridges down in the mud with steel rails and haping to God we'd anchored them in the right places. It was terrible work, no rest, no decent food, no place to sit down and relieve your aching insucion. Only hollering women and shivering kids. And soldiers riding around in rowboats. Well, it was

just seven months before I got home.

"THE old double-decked suspension hidge over Niagara Falla was another tough job. It's always hard to get materials over rushing rivers—and, of course, a slip means death. hazarda on bridges are always considerable. The Quebec span, which fell twice, took a lamentable toll of life. On the other hand, several important bridge spans have been erected without accidents: the Philadelphia-Camden suspension bridge, greatest in the world, the famous Bear Mountain Bridge, 400 feet above the Hudson; the great Queensboro Bridge, which connects Manhattan and Long Island City."

Diehl has had his accidents, too. Once, at James River, Va., he fell 65 feet, and while it may not sound like a soft landing spot, he was mighty grateful to come down an a pile of from cross rode. They bounced him up and down, and although he couldn't work for a month and was arnica from head to foot, he's alive to tell and grin about it. Another time, when he went into emergency ship construction at Port Newark during the war, on what was known as "Fancy Ship 18," a 816-ton plate hit him and broke both his ankles. He knows, too, how it feels to have four ribs broken.

Up to 10 years ago he was seldom home. The States, Mexico, Cuba, Brazil, Canada, all claimed him. And yet he didn't travel as widely as some. Quite a few American bridgemen have worked from Alaska to South Africa.

The work that appears least to Diehl Is New York s subways.

"You re being showered all day long," "Dirt and muck from the he mays. street above down your back and in your eyes. All day long the stuff comes down on you, till you think you'll go crasy. But it's not dangerous work, because you can't fall far. Some of it's hard work, because very often heavy tonnage has to be handled to support buildings overhead. The Commodore Hotel and the Bowery Savings Bank, on Forty-Second Street in New York, are both sitting on subways.

"The elevated was much more fun. That was something like bridge work. Back in the eighties I worked on one of the first elevateds. In those days we used wrought from and we had to hammer by hand the rivets that held it together.

(Continued on page 162)





Amazing New Facts About Old Age

"Did you know that two-thirds of all men peet a certain middle age suffer with a certain seldom mentioned dis-

"By the medical profession this is known as hypertrophy of the prostate gland. And scientists have now rerealed that it is directly responsible for much of what many people mistake for actual old ago."

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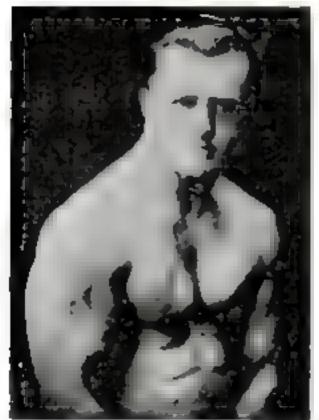
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Every Day's Work a Gamble with Death

(Continued from page 101)

We had no such things as pneumatic riveters or compressed air. And we had to do 500 rivets a day. Nowadays if you get 500 rivets out of a man using a riveting gun you're lucky "

Up in the air any sort of a job in wet or cold weather is treacherous.

"The men can't work properly in winter," says Diehl. "Let a drop of rain come down in cold weather and you see the boys come hurrying down, can't blame 'em. The instant a drop of water touches cold steel it turns to ice And a beam is hard enough to walk on when you've got everything in your favor.

"Nowadaya we believe in taking as few chances as possible. In the old days, the boys used to love to give the crowd a thrill. They'd take unnecessary chances : on the beams, they'd ride the ball, they'd go up and down with Iron, grandstanding I never let any man of mine nde steel And I won't let any bellringer of mine tolerate it when I'm not around. No, siree. Suppose the engineer has a audden attack of heart failure and taken his hand off the throttle? Say it with flowers?

"Because we don't take the chances we used to, hardly any one gets hurt nowsdays. Of course, the men always are getting their hands and fingers immined. or getting clipped with rivets, or getting bumped by swinging girders. But they don't really get hurt much any more There were only a few killed the country over last year on steel jobs."

T'S a wonderful trade, thin fushioning of great buildings. And it happens to be peculiarly American. A half century ago, when Diehl ran away from home to his first job, masonry construction towering nine stories was considered the maximum. for safety and utility. Then with Beasemer steel and, later, open-bearth steel, a material that would perform with mathematical exactness, the sky became the limit. Bomemer steel, developed between 1860 and 1860 by Henry Bememer in England and William Kelly in America, was the first really economical steel, for by passing air through melted cust from in a converter they showed how to remove impurities from the molten mass in 15 minutes. Open-hearth steel, developed by William Seimens in 1860. did the same thing only better, bringing forth from a gas-burning furnace a prodnet virtually uniform in chemical and physical properties.

Both processes have made possible the economical mating of large ingots from which various shapes can be rolled. They have made possible the vast network of steel girders that will form the world's largest office building near the Grand Central Station. They have made possible, too, such gigantic projects as the great bridge across the Hudson River, for which the first preliminary survey has just been completed, and the world's loftiest skyneraper, newly planned to rise above the Woolworth Tower.

And so on with the joy-ride!



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How a Cowboy-Aviator Hunts Wild Horses

(Continued from page 17)

western tribes, and these animals, escaping in turn, became the nucleus of the wild-horse hands that now wander northward as far as Montana.

While most of these horses—especially in the northern states—are of the ordinary mustang type-small, shaggy, and unbeautiful, but capable of great endurance -often there will be "throwbacks" that show Arabian blood in every line of conformation and in color. Such "throwbacks" make up the wild bands of pirtos (the Spanish "paint"), which are the spotted homes commonly associated with the circus. Occasionally an entire pinto-band will be found rossung from one water hole to another in the desert regions. They are as fleet and cunning on they are beautiful, but they are looked upon as rare prises today, for they have been hunted so extensively that few of them remain.

"I'E's a queer thing about a horse band," said Chance Parry. "Some of the horses will make first-class saddle ammals and others in the same band never can be broken. I've taken a first-class saddle horse from a wild bunch-a horse that was easy to break and a first-class horse to ride. In the same bunch I've picked up an outlaw that never can be ridden and now is being featured as a bucker at rodeos.

"It a rider gets near enough to rope a wild horse, he sees that the end of his rope is made fast to the sureingle, which is all his mount carries in the way of trappings, besides the bridle. If he ropes the horse, the rider may get a bad apill Or the horse may fall and break a leg or perhaps its neck. A band of wild horses may run in numbers from six to 30 or 40 Each band is under the leadership of a stallion. It is that stallion's job to look after the welfare of his hand

"If it wasn't for the fact that they are driven to the water holes by thirst, the horses never would be caught in any great numbers by the present methods. The best way to catch a hand is to build a trap at a water hole. But after the trap has been built, the work has only begun.

TRAP is a big corral, with a smaller one inclosed, for the branding. After the trap has been built, everybody deserts the water hole, except one man, who is left on guard, concealed in a int. It is his job to put up the corral bars, in case the horses walk into the trap. He may have to lie bidden there a day or two before a wild horse band comes in to drink.

"The horses come in slowly, because things don't seem right to the stallion, who doesn't like the looks of the corral. If the wind is in the wrong direction, the stadion will stuff suspiciously and then make off, the whole band following. I believe a wild horse has the keenest sense of smell of any animal.

"Once we had our eye on a certain band of horses and built a trap at a water hole. The stallion was auspicious from

(Continued on page 10-1)



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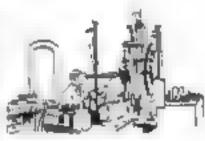
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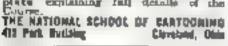
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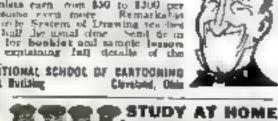
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How a Cowboy-Aviator **Hunts Wild Horses**

(Continued from Juge 163)

the start, and when he finally brought the hand to the hole, we knew the animals had been without water for five days. They came in slowly, the stallion leading. They were at the top of a hill several hundred yards away, when the man who had been left at the trap raised his head slightly. He ducked down instantly.

"The movement took only a fraction of a second, and the man hardly showed the top of his bead above the sagebrush But, quick as he was, the eye of the stallion was quicker. The leader of the band turned and ran, and the other horses followed. They were almost perishing for water, but the stallion led the horses to another water hole 35 miles away, just because he had seen that one suspicious move.

LIKE other animals, wild horses are creay about salt. We captured one of the finest bands of horses I over have seen, simply by scattering blocks of salt around in a corral. We had built the gate of the corral so it would swing inward and close likelf by its own weight. The horses were eager to get the salt, but the stallion was suspicious and held them back. Finally the stallion concluded that everything was all right, and pushing the gate open, began licking the salt. The marce and colts followed, one by one, and pretty soon we had the whole band trapped.

"But after you get a wild horse in a corral, it's no cinch that you're going to slap your brand on him. The wild horse is a great jumper and he will risk his neck to make a getaway. Once I trapped a mure and two colts. They were beautiful animals and I was shaking hands with myself when I got them in the corral. I put up three bars of the gate, worlding from inside the corral, and I thought the horses were as good as mine. The mare kept trotting around the corral, with the colts following. I needed another bar or two to make the gate the full height of the corral, but it was a good six feet as it stood.

The mare however, concluded that the gate was not going to be built any higher She made a dash at me as ahe came around the corral. Her cars were back, ber teeth were showing, and fire was shooting from her eyes. I knew she neant murder if she could get me within reach of her hoofs, so I climbed the corral fence and didn't lose any time getting to the top. The mare dashed past me and with a mighty jump cleared the top of the gate just like a bird, and the colts followed—just like two more birds. If ever horses gave any one the laugh, they gave it to me as they galloped away from the trap at that water hole!"

UP TO four years old, there is some chance of making a good saddle horse or work animal out of a wild horse. After that age, a wild horse is always a wild horse. He may be broken and he may travel along with you all right, but he will always be looking for a getaway.



November, 1925

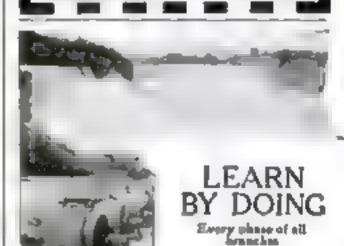
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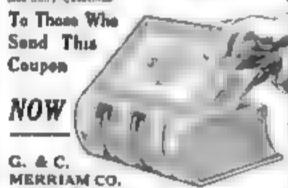
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How a Cowboy-Aviator Hunts Wild Horses

(Continued from page 10-f)

"I had one particularly fine home that was about five years old when I caught him," Parry went on. "But he was so good that I thought I'd take a chance on breaking him and making him over into a good pack animal. I kept an eye on him for a while, but he was no docile that be fooled me.

"Then, when I was out on a long trip, this fellow pulled his picket pin one night and left me with a heavy pack to distribute among the other pack animals."

When a wild horse gets away from you after you think you have him broken, you can generally figure on his taking one or more of your other house along.

IN SOUTHERN Utah I was told of a big band of wild horses that caused ranchmen tremendous trouble by recruiting from a domestic stock. At its head was a big battle-scarred roan staltion. Seen through field-glasses, these scars bore mute testimony to his supremacy as a leader. For among wild horses a stallion can continue as a leader only as long as he can defeat contesting

This big roan was wise and speedy as well as an able fighter, and it was a big job to catch him, but finally he and his whole band were trapped. When the bunch was corralled, it was discovered that the horses carried brands of ranchers in governi different parts of Utah. That stallion had recruited his band, one by one, and found layed supporters even among horses born and bred on the ranches. And these latter were just as wild as the others.

But not all the ranch horses listen to the call of the wild," said Parry. "And there's aniling reminiscently nothing like a good old dependable work horne, that alsee atfaifs better than same picking on the range, to take the nonsense out of some of these wild horses

"When we capture a promising sot of young horses, we frequently take a couple of them and fasten them on either side of a faithful old mure. Tied head to head, we turn the three of them out on The young horses start at the range once for freedom, drugging the old mare along with them. For a while the wild horses have their own way, dragging the old mare along with them. Then the strain begins to tell on them.

"Along about evening the three horses show up at the ranch, the old mare bringing the wild homes along with her And maybe those bronchos aren't tired! After three or four days of that kind of thing, they are willing to listen to reason "

in soite of the constant search for them by hunters like Chance Parry, in apite of their being shot by hundreds at water hoies, rounded up and exterminated by thousands in Montana, I believe that wild horses will continue to roam the Western plains for many years. Not even Parry's plan of hunting them out by airplanes will totally eliminate these splendid animals from the rugged Colorado River plateau, where they have run in freedom for hundreds of years.



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Rate 30 Cents a Word. A 10% discount is allowed an all contracts for the consecution insertions. Advertisements intended for the Jan. 1976 ignor chantel be recovered by Nov. 5th

Prize Winners in September Contest

The first prize of \$10.00 goes to fames Montgour of Canton Ohio, for his letter on Bere u Mr Paimer's advertisement Monttone is letter.

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Mr. George J. Booth, Charago, Illinois, with the second prize for the following letter on the advert sements for District Managers area Representatives Wanted " This is his

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Very ray round, Group L. Heath.

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The third price goes to Mr. Cecil C. Kerr, of Fremont, Va., for his let er regarding the American Monogram adversisements the letter

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Very truly group. Co.d.C. Kery



The winners of the other seven prizes and the names of the advertisers they wrote about are

> Withort Whitfield, Frament, Hebri Motorists Accessories Companys

Robert T Williams, Boise, Idaho (Home Advertising)

C. W. Soyle, Reachurg, Oregon. (Typewriters & Supplies)

Albert J. Bashien, Chicago, Illinois (Chalk Yalk, Cortaming ada)

W. E. Stobbe, Cleveland, Ohio (American Photography)

Duellay Turnar, Holly Springs, Miss. F. C. Godel

M. G. Somer, Taft, California W. T. C.

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FTART overprious business. \$1 Freech 1903 E. Chans Battlenors, 51d. Free circular B.

INCH Display Advertisement 100 Manathes,

How a Strange Accident Saved Me From Baldness-

Sixty days ago it made me boiling mad. Today I look back and laugh at the incident for it brought me a marvelous new growth of hair

M willing to bet that I've wasted more money trying to end my baldness than any other man in the world So naturally I laughed at any ad that sounded like a baldness remedy. And the oftener I laughed, the more bald I became.

When my wife began to look sorrowfully at my thinning heir I sended regretfully. When my friends began to call me "baldy" I felt somewhat annoyed. But when my private score any began to look arrangely at my glatening scalp and ameker—well it made me mad

But the worst was yet to come. About stary days ago I saw a tooth paste adverthement that offered to send a free booklet It sounded interesting so I clipped the coupon and gays it to my secretary to fill in

Well, a few days, later, to my utter turprise, I found on my desk-not a booklet on toothpasto-but a booklet and a letter telling how to end buildness in 30 days!

glanced from the booklet to my secretary.

I felt my blood bossing.
"At an Harris," I said to her, "I can't She paied. Why, Mr Burns-what's wrong-what baye I done?

"Done?" I shouted, "aren't you content with suppling at my bald head must you make matters worse by sending me that hint. If it pains you to look at my head you are always at liberty to reago". Tears came into her eyes. And between sobs also explained why it wasn't really her

last in

the said that the coupon which I asked her to mail had another coupon printed on the back-and the other enupon offered to send a free book about baldness. Well, she "Hm," was all I could say And dur-

my the entire day not a

word passed between na. Hut that night on my way home I read the book about baldness. book a more interesting, more helpful, more honest book I've never read to my life. It described an en-

tirely new method of making hair grow — a method perfected by Alous Merke, founder of the Merke Institute, Fifth Avenue, New York. It in the only treatment I had ever beard of that setoday reacted right down to the hair roots and awakened them to new,

regarous activity As I read on I felt rayself weakening in my

resolve not to try another hair trea ment And then when I read that Merke actually guaranteed a new growth of hair in 30 days of no cost to me-were I completely weakened and sent for the treatment,

The first two or three times I used the treatment I began to notice that my var didn't fall out as much as it used to. But a week or to safer when I looked to the mi ror I saw something that almost bowled me over! For there, just breaking through, was a fine downy fuzz all over my head.

Every night I spens 15 minutes taking the treatment at home. And every day this young hair kept getting stronger and thicker. At the end of a mouth you could hardly any a baid spot on my head, And at the end of pixty days—well, my wor ries about baldness were ended. For I had regained an entirely new head of healthy hair,

t an your blame me for laughing to me or the straums incident of (ii) days ago?

Read This!

"Results see wonderfu. My hour has unspeed falling a sing I can see lots of new has coming in. I F. D. R., Washington, D. C.

"My hate was coming out at an alarming rate, but after four or five treatments of the transcents of the transcent of the lde and vigor Next, N. V W L Great

"I have used your systems for eight weeks and a though the top of my head has been councily hald for the years the result up to the present are grantong in fact the course hold upon at covered with a one green of hair W B. Ken-

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This new treatment, which Merke perfected after 17 years experience is (realing baldoes), in the first and only practical method of periods right down to the last meets and mountaining

At the Merke Institute many have pass as buth as \$400 for the results secured thru personal measurems, Vex now these very same results may be becared in any home to which there is electricity -

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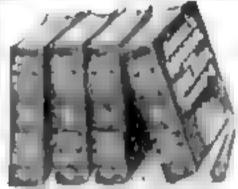
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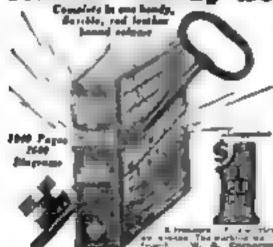
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The Battle of the Ants

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(Continued from page 2.1)

the intricacion of higher calculus; but he does seem to be able to count, and that is more than a lot of animals can do. For matance, Ormond Francia Williams, an ant expert of Bridgeport, Conn., tells how on a walk in the woods one day, he sicked over a stone with his foot and ungovered numerous cocoons in which the pupe were developing. He picked up a couple with a small twig to investigate them. Meanwhile the excited anta below began to carry their treasures off to the nest. They took away all the pupm that remained on the ground. Then they came back and looked around. They could see nothing more to get, but still they hunted. The unto evidently had counted the pupm and knew there were just two missing, for when the latter were put on the ground again they were seized and carried off.

THE aut is the perfect numerical. As soon as the queen has laid her eggs, workers come acurrying to the spot. Each one saises an egg in his mouth-holding it very gently-and carries it to a specially prepared chamber, warm and molet.

Once there, they classify the eggs according to sizes, and when the larve emerge, they are placed in a circle with their heads pointing away from the center, so that the nurses can hurry around the outside and give them nourishment.

There is a species of ant in the tropical countries that takes its young outside on nice warm days, and parades them up and down, just like the numerosid-babyperambulator combination so common in the human race. The ant numericals are even more insistent on cleanliness than are the human species. They keep in the nest a sort of moist sponge made out of various noft materials, and whenever a young ant gets its mandibles all dirty or splantes mud on its antenna, the nurses burry it to the sponge and wipe its face.

IF WE could find some way to make an ant unbosom himself and, speaking right out from the heart, tell us which of his various marvelous accomplishments makes him proudest, he would probably say, "My strength!" and then laugh at us condescendingly. For the ant is such a wonderful all-round athlete for his size and weight that he makes the most powerful man on earth appear a weakling

Here is one of his leaser feats as described by the naturalist, A. D. Du Hois-An ant was observed carrying a pebble from the bottom to the top of a mound. The ant and pebble were weighed, and the beight of the mound was measured. For a man to do an equivalent piece of work in proportion to his size, be would have to carry a trunk weighing half a ton up 25 flights of stairs.

If that seems marvelous, consider this: A little field ant, in a carefully arranged laboratory test, held in his jaws a weight 3000 times heavier than itself, without difficulty. For you or me to equal that, we would have to be able to stand calmly on the edge of some convenient

(Continued on page 174)



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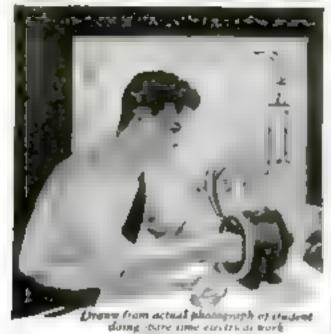
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The Battle of the Ants

(Continued from Bate 173)

precipice while eight freight cars loaded with fron dangled from a chain passed over our lower jaw

A well-known entomologist has asserted that if any man weighing 150 pounds had the same strength in perpertion to his weight as the aut has, he easily could hoist two of the largest modern locomotives on his back and walk away with them, without even staggering

There is a species of ant in Africa. called the "bulldog," which Professor Wroughton tells us, can travel along in great leaps a foot long. If modern man without o emulate this achievement, he will have to increase the present broadjump record from alightly over 25 feet to 144 feet.

The ant is a farmer. It may sound unbelievable, but he has his own gardens that he cultivates, and in which he raises special foods found nowhere else; and be has "stables" wherein he keeps "cows," which be "milks."

Consider, for instance, the ante called the "leaf-cutters," They slash off leaves from trees with their sharp mandibles, carry the leaves down into the nest, and there chew them up into a fine paste that they aprend on the floor. Meanwhile other ants have been hunting mushroom slips, which they now carry in and plant in the prepared "soil." The result is a fungous growth that seems to be one of the invorte ant foods.

THE ant's "cow" is the aphid, the green-fly of our gardens. The ant seizes these little creatures, takes them to the next, and there shelters them and feeds them. In return for this, the aphyla give off a honey-dew "milk" when stroked by the ant's antenna, and this honey-dew la the ultimate in boverages for the ant-

Did you ever think of the ant se a surgeon? He is, though his operations are rather heroic. Among the Brazilian leaf-cutters the following technic is omplayed: When a patient is brought in suffering from a bad wound, the ant surgeons eatch a few buge soldiers who won't be trusted, and, holding the edges of the wound close together, induce a soldier to close its jaws in them. The unfortunate soldier then is decapitated. A number of these "stitches" are put in, according to the length of the wound, and they remain firmly locked and the wound is healed fully. One well may quartion whether the disease is worth the

Finally, we may note that the ant has that trail so extremely rare among ammais-he buries his dead in a cemetery, and with a regular funeral processor. Members of the colony lift the dead body with their mandibles, and, others following in solemn line, they go outside the nest to the little plot of ground where they bury their corpoen.

There is much more that this marvelous little creature, such a wonder-worker for his size, can do. In the rôles in which we have considered him we have seen him versatile beyond all belief. As to what other wonders he would make known to us if only he could talk, we can but guess.



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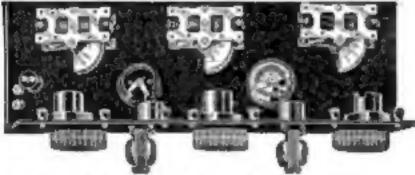
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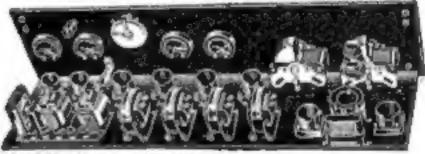


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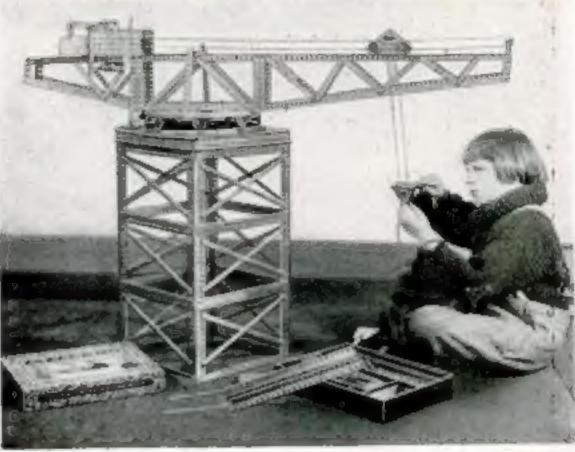
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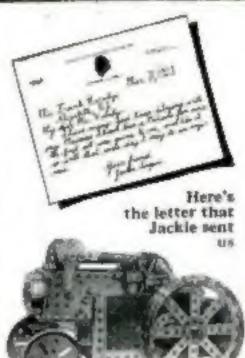
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